AN INDUSTRIAL PUBLISHING CORPORATION MAGAZINE

AUGUST 1959

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ANN ARBOR MICH
PIZ

Precision Metal Molding

PMM

INCLUDING DIE CASTINGS MAGAZINE

DIE CASTINGS

EXTRUSIONS

INVESTMENT CASTINGS

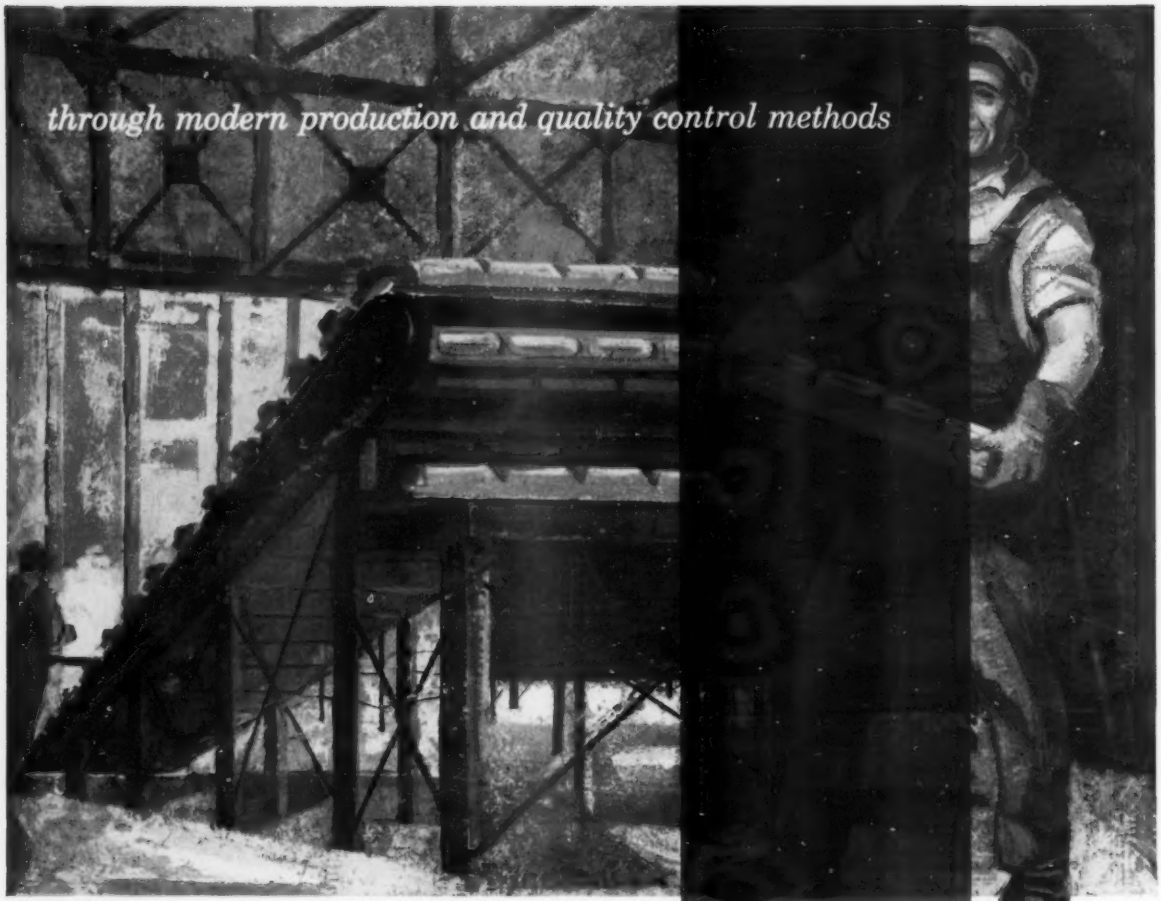
PERMANENT MOLD CASTINGS

PLASTER MOLD CASTINGS

SINTERINGS

SHELL MOLD CASTINGS

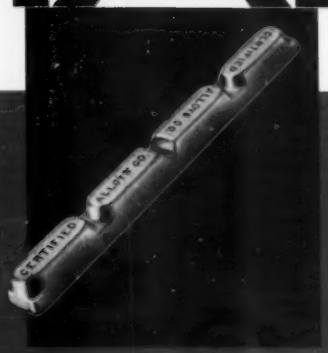
"We had to be sure . . . and it took four years."
see page 3



UNIFORM HIGH QUALITY

ZAMAK

ZINC BASE DIE CASTING ALLOYS



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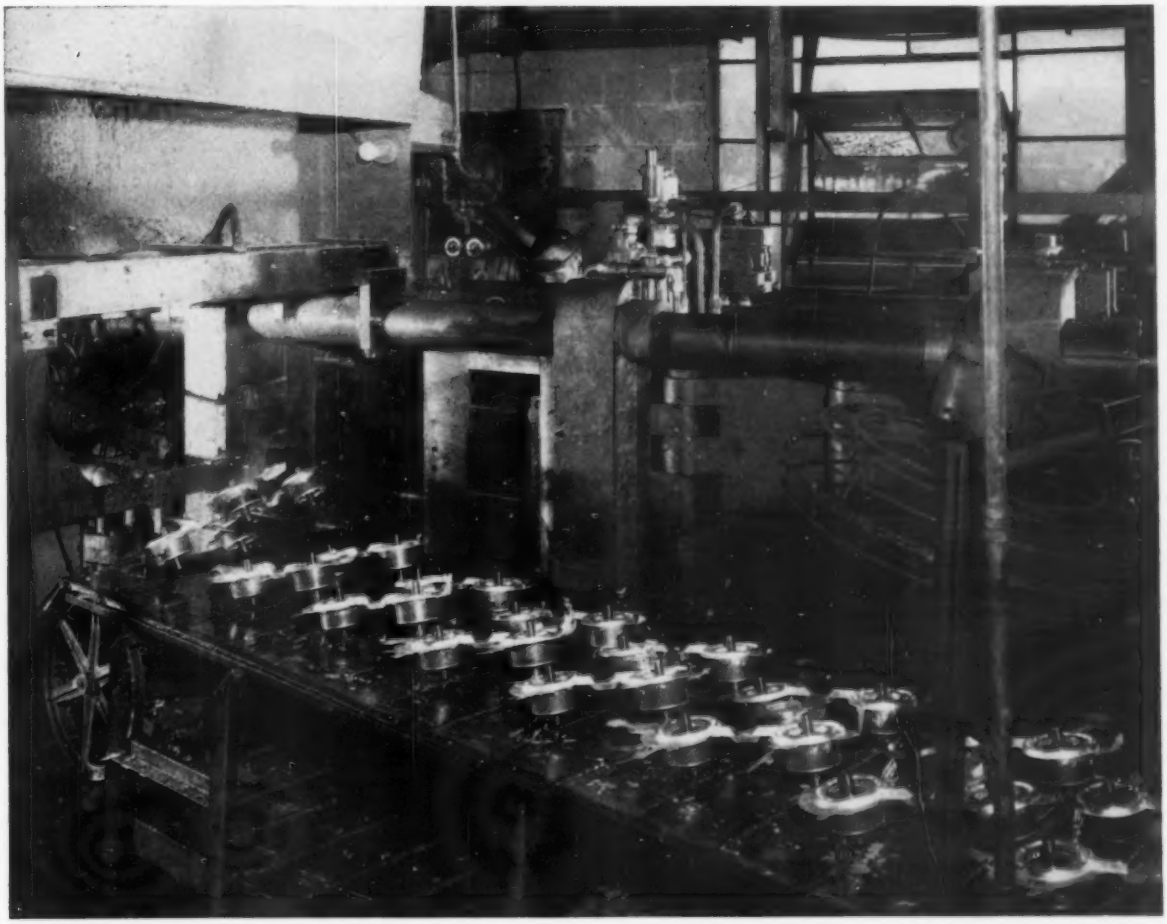

DIE CAST ALUMINUM ROTORS with insert laminations are automatically ejected, lifted to the conveyor and delivered to the next station for gate removal. A four cavity mold is used on this 500 ton Cast-Master.

24 HOURS A DAY, 7 DAYS PER WEEK

Downtime Negligible

Two good examples of Westinghouse Electric Corporation's die casting production at Bellefontaine, Ohio . . . a 100% Cast-Master shop. These hard-working casting machines are used 'round the clock producing a variety of electric motor components as shown in the two photographs. These are 500 ton Cast-Master cold chamber machines for casting aluminum, magnesium and brass. They're designed for the demanding needs of appliance manufacturers like Westinghouse who rely on uninterrupted production to meet growing market needs.

The Cast-Master line includes machines from 100 to 2000 ton capacity with flexibility of design to adapt to your most individual problems. Specifications can be changed to provide special shot end arrangements, large die plates, extended tie bar centers, special injection, automatic lubrication, safety features, special hydraulic circuits, variable gooseneck positions, special electrical controls, etc. All Cast-Master die casting machines are illustrated and described in new catalog CM-100. Ask for your copy, today.

DIE CAST ALUMINUM MOTOR BRACKETS are produced in a two cavity mold at the rate of 2600 brackets each day. The convenient accessibility of the hydraulic system is shown in this view. Cast-Masters are designed for more production, less downtime.

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CAST-MASTER

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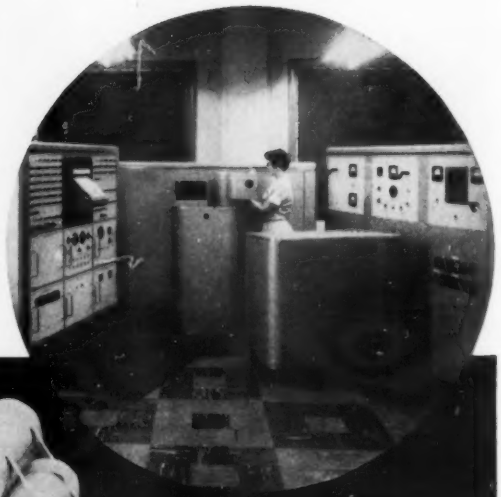
ALUMINUM EXTRUSION
BILLET



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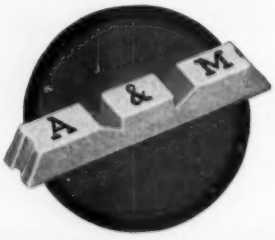

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IN THIS ISSUE

August, 1959: Volume 17 Number 8

COVER

DISCUSSING the intricacies of the sintered accumulator wheel used in the Victor calculators are (l. to r.) Kenneth L. Bick, design engineer, and William F. Coursen, chief special products engineer. Four years of research went into the development of this small part which plays a vital function in the operation of Victor office machines. This tiny wheel is an outstanding example of what can be done with powdered metal, and the complete story appears on Page 27.

FEATURE ARTICLES

27 SINTERING MEETS VICTOR'S EXACTING DEMANDS
It took four years of research to develop a powdered metal wheel for an office machine which could stand the service requirements and be produced at a saving.

28 DUPLICATING MACHINE USES 35 DIE CAST PARTS
Duplicating machines must be built to last, but they must also be priced within the pocket book of the average office. That's why die casting is a favorite production method.

31 CASTINGS FOR HIGH STRESS APPLICATIONS
Gyros on aircraft have to withstand extremely high stresses. With a plane flying at mach 1 or 2 the stresses imposed on components are high. Permanent mold castings hold up.

32 EXTRUSION DIE FAILURES
Extrusion dies seldom fail in service. When they do, here's a check list to help locate the cause.

34 PROPERTIES OF EXTRUSIONS
This month the effect of extrusion on some commonly used steels is given.

36 ICI STANDARDS, PART III
The last of the most recently issued ICI standards covers acceptance standards for airfoil sections.

38 MELTING AND HOLDING FURNACES
The manner in which aluminum is melted and held before casting can greatly influence the quality of castings and the metal economy.

40 ADCI STANDARDS, SERIES E
This engineering standard covers ribs, fillets and external corners. Adherence to these standards will give the best die casting at the lowest cost.

43 CUT WEIGHT & MAINTENANCE ON BOX CARS
Ingeniously designed extrusions form a liner for railroad box cars. Life of the car is improved and weight is materially lowered.

45 DESIGN TIPS
This month's tips show more correct uses of cast-in inserts in die and permanent mold castings.

46 CAST GUN PARTS SCORE BULLSEYE
Parts used in firearms must meet rigid requirements, and that's why leading manufacturers are taking advantage of the investment casting process.

58 SINTERINGS REPLACE STAMPINGS
Through the use of sinterings, one vending machine maker has lowered his manufacturing costs and produced a more service free machine.

70 INCREASE PIN SPRING LIFE
The development of a new alloy tremendously increased the life of knockout pins on shell molding machines.

72 DIE CAST ENGINE BLOCK DESIGN
This patent covers a solution for the economical design of a die cast aluminum V-8 engine block.

FINISHING SECTION

49 DIRECT CHROME-TO-ALUMINUM PLATING
The Chrome-Lume process deposits a ductile, strongly adherent coating of chromium directly on aluminum. No intermediate zinc layer is required.

52 HIGH STRENGTH WELDS IN ALUMINUM
Not every shape can be cast in aluminum. But castings, or wrought parts, welded with Tens-50 can be heat-treated to give welds with higher strength than the parent metal.

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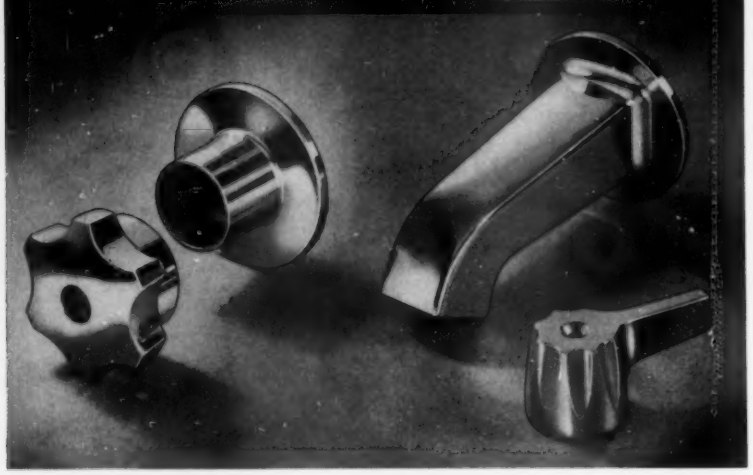
QUALITY is a FIXTURE at L.D.C.



. . . and these fine finish plumbing fixtures tell you why

Quality is fashioned by craftsmanship. Take these sparkling chrome plated zinc castings. Note their modern, graceful lines and soft, smooth finish . . . made possible only by the qualities of purity and surface soundness and uniformity of the alloy; and the rigid maintenance of close tolerances by controlled production methods and equipment.

And here is something else! The serrations for the mating spline in the handles of these fine fixtures are held to close dimensional tolerances by reason of the identical same qualities that govern the economical production of these castings.

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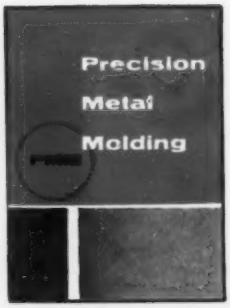

published monthly, copyright 1959 by

THE INDUSTRIAL PUBLISHING CORP.

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SUBSCRIPTIONS in U.S. and possessions: $7, 1 year; $12, 2 years. Canada: $8 per year. Foreign: $10 per year, payable in advance in U.S. funds. U.K.: £3.5.0 per year payable in Sterling to London office. Single copies, when available: 1 to 10—75¢ each; 11 to 25 60¢ each; over 25 45¢ each.

AFFILIATED PUBLICATIONS: Applied Hydraulics & Pneumatics, The Refrigeration & Air Conditioning Business, Material Handling Engineering (formerly Flow), Material Handling Illustrated, Modern Office Procedures, Occupational Hazards, Power Transmission Design, Welding Design & Fabrication, Welding Illustrated. Member BPA.

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Why not find out now if powder metallurgy holds the answer to your high parts costs?

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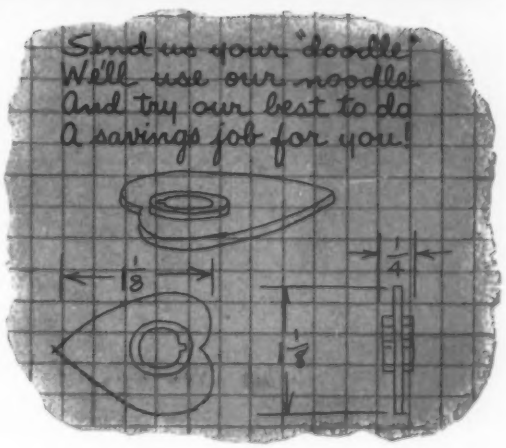

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When it comes to metal powders selections . . . be sure to

specify HOEGANAES

. . . the complete line of metal powders that give you the properties you want—for the metal parts properties you want to produce

Here's *the* master check list of iron powders—highlighting the outstanding properties of Hoeganaes Iron Powders. If yours is a special problem, take a second look at this list . . . locate that grade best suited to your specifications. Then, call in the HSIC service specialist . . . he'll answer all detailed questions.

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Known throughout the powder metallurgy industry as the "work horse" of the industry. Famous as the world wide standard for uniformity, compressability, iron carbon parts production and copper infiltration.

MH-100-S EP-1024

Equally famous for the properties above, plus improved compressability and purity. The "right" powder for production of large parts or higher density parts.

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On down over the years, Ancor 80 is still the outstanding choice for green and sintered strength.

PRE-MIXES

You too, like so many parts fabricators, can eliminate your mix department worries. It's just this simple. Let HSIC produce and guarantee the proper composition for your requirements. HSIC now offers and supplies every conceivable iron base mix . . . including low alloy steel compositions for outstanding strength and other physical properties.

STAINLESS,

Inconel, Monel and other high alloy atomized powders.

Including low carbon, low silicon stainless, Hoeganaes now offers the most complete line of high alloy powders.

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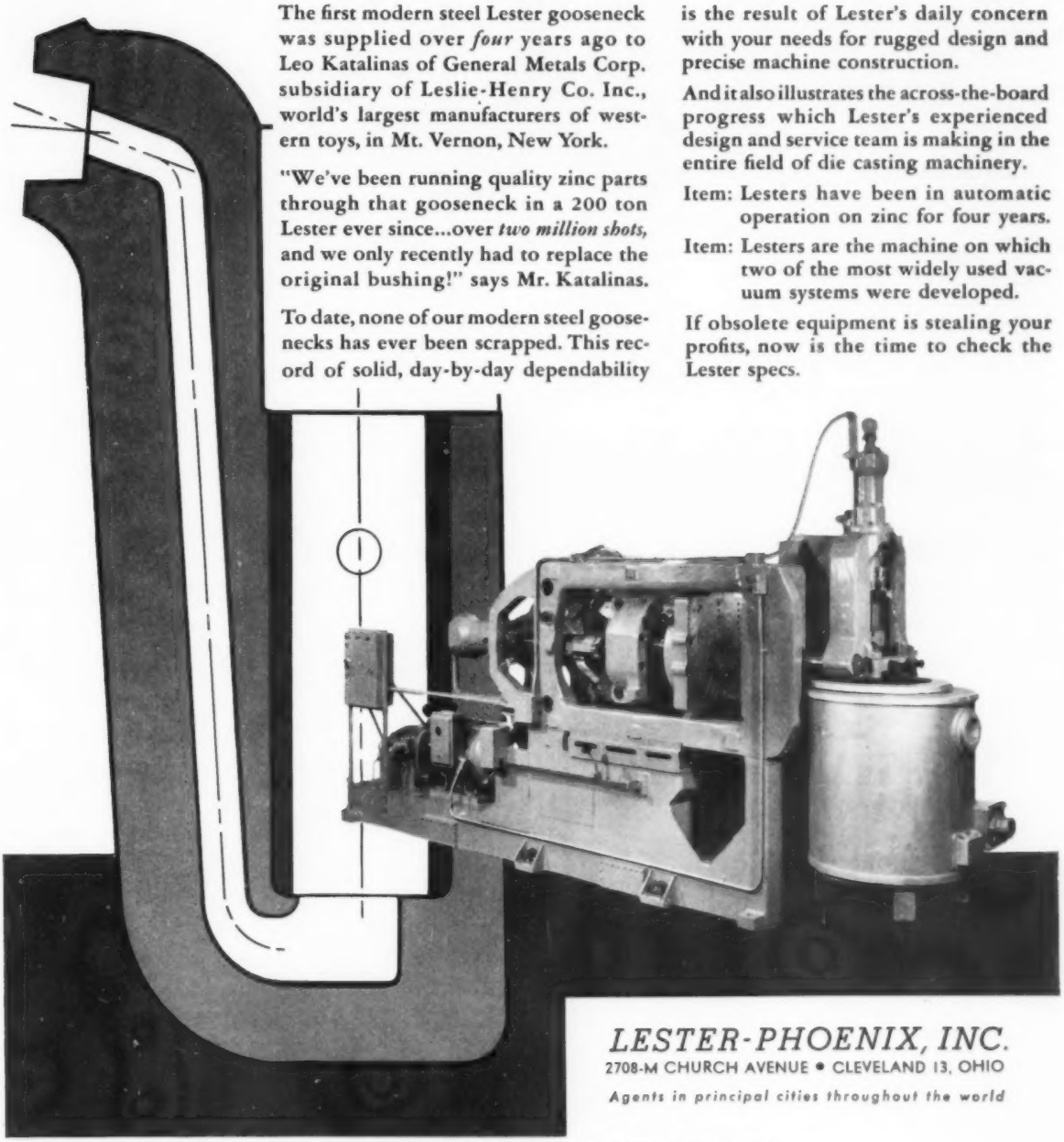
"TWO MILLION SHOTS ...and still going strong!"

DEPENDABLE LESTER GOOSENECKS TYPIFY RUGGED LESTER MACHINE DESIGN



The first modern steel Lester gooseneck was supplied over *four* years ago to Leo Katalinas of General Metals Corp. subsidiary of Leslie-Henry Co. Inc., world's largest manufacturers of western toys, in Mt. Vernon, New York.

"We've been running quality zinc parts through that gooseneck in a 200 ton Lester ever since...over *two million shots,* and we only recently had to replace the original bushing!" says Mr. Katalinas.

To date, none of our modern steel goosenecks has ever been scrapped. This record of solid, day-by-day dependability is the result of Lester's daily concern with your needs for rugged design and precise machine construction.

And it also illustrates the across-the-board progress which Lester's experienced design and service team is making in the entire field of die casting machinery.

Item: Lesters have been in automatic operation on zinc for four years.

Item: Lesters are the machine on which two of the most widely used vacuum systems were developed.

If obsolete equipment is stealing your profits, now is the time to check the Lester specs.

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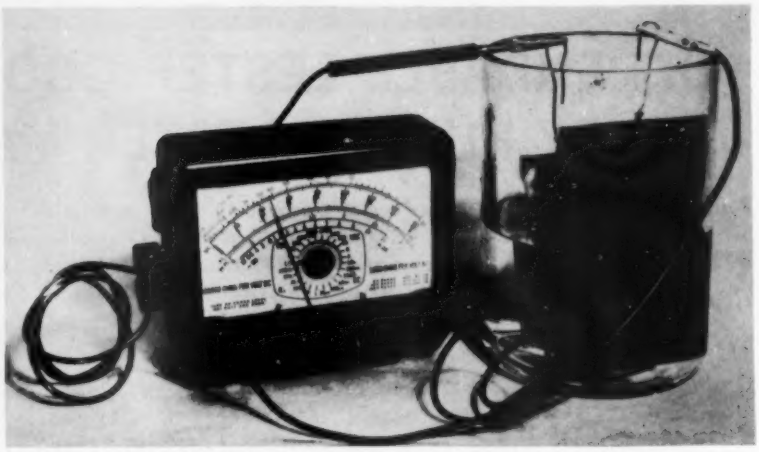
CASTING ABOUT

technical news of applications & processes involving precision metal moldings

AN ALL INORGANIC ZINC coating which combines the corrosion resistance of zinc with the galvanic protection of zinc on ferrous metals has been developed by the Carboline Co. The new coating called Carbo Zinc #11 is useful at temperatures from minus 80°F to plus 750°F due to its Si-O-Si vehicle. When applied to ferrous metals, such as cast parts, subjected to salt water corrosion all sub-film rusting is eliminated.

The maximum, theoretical potential between zinc and steel is 0.72 volts. When immersed in salt water the potential between this coating and the base metal is from 0.55 to 0.60 volts, very close to the maximum.

The coating is reported to cure at temperatures as low as minus 20°F and as high as 750°F. It can be applied, and will cure, in atmospheres with from 90% to 100% relative humidity. Normally the coating is water resistant within 20 minutes.



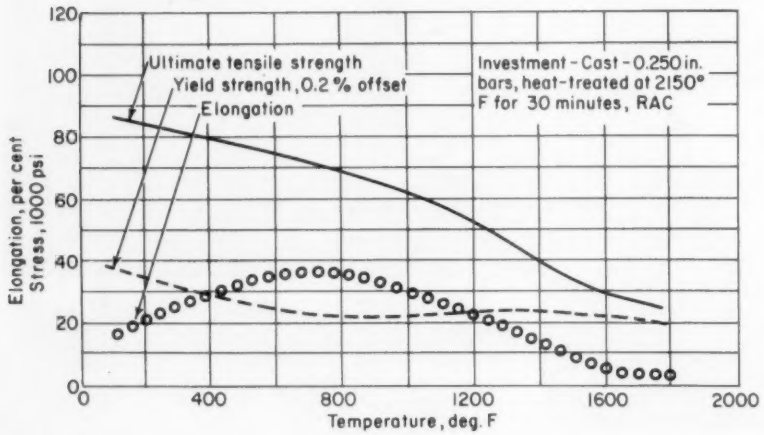
GOOD galvanic protection from the new coating.

A COPPER ZIRCONIUM ALLOY with good room temperature and high temperature strength, excellent fatigue properties and high electrical conductivity has been announced by American Metal Climax, Inc. Known as Amzirc, the alloy contains only 0.12% zirconium. It responds to cold work and aging to give desirable combinations of ductility and strength. A typical bar of Amzirc when cold worked 60%, and aged for one hour at 400°C has these properties:

Ultimate tensile strength	63,000 psi
Yield strength	59,000 psi
Elongation	12%
Electrical conductivity	90-95%

At 400°C, the short time tensile strength is 46,500 psi. Additional cold work increases the tensile strength without sacrificing ductility or electrical conductivity. By cold working the tensile strength can be raised materially. For example when cold worked 85% and aged the tensile strength is 72,000 psi, yield strength 61,000 psi and elongation still 12% in two inches. The endurance strength of hard drawn and aged Amzirc is in excess of 28,800 psi in contrast to hard drawn copper which has an endurance strength of only 17,000 psi.

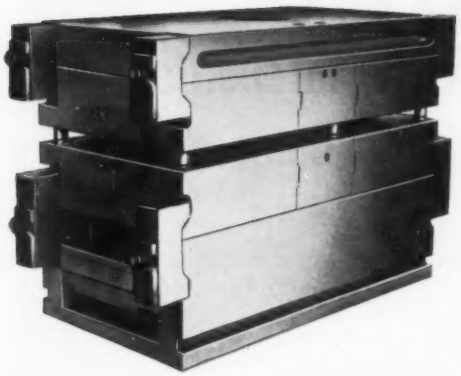
A DEOXIDIZING AND DENITRIDING metal to be used in the vacuum arc melting of titanium has been reported. Johnson & Funk Metallurgical Corp. have developed this new method of ridding titanium of its two worst contaminants. In practice, as the titanium is melted oxides and nitrides which are insoluble in molten titanium are formed. Gaseous contaminants are, therefore, eliminated from the vacuum melted ingot. Titanium with up to 12% oxygen can be melted by this technique and the resulting ingot will contain less than ½ of 1% oxygen, well below the embrittling level.



A NEW NICKEL ALLOY which shows excellent resistance to fluoride salts has been developed by the Haynes Stellite Div., Union Carbide Corp. The nominal composition of the alloy is:

Chromium	6.00-8.00%
Molybdenum	15.00-18.00
Iron	5.00 max.
Silicon	0.50 max.
Manganese	0.80 max.
Carbon	0.04-0.08
Nickel	Balance

The alloy can be hot and cold worked in the usual manner, is extrudable and can be shell, investment and sand cast. Typical properties of heat treated investment cast test bars are shown.



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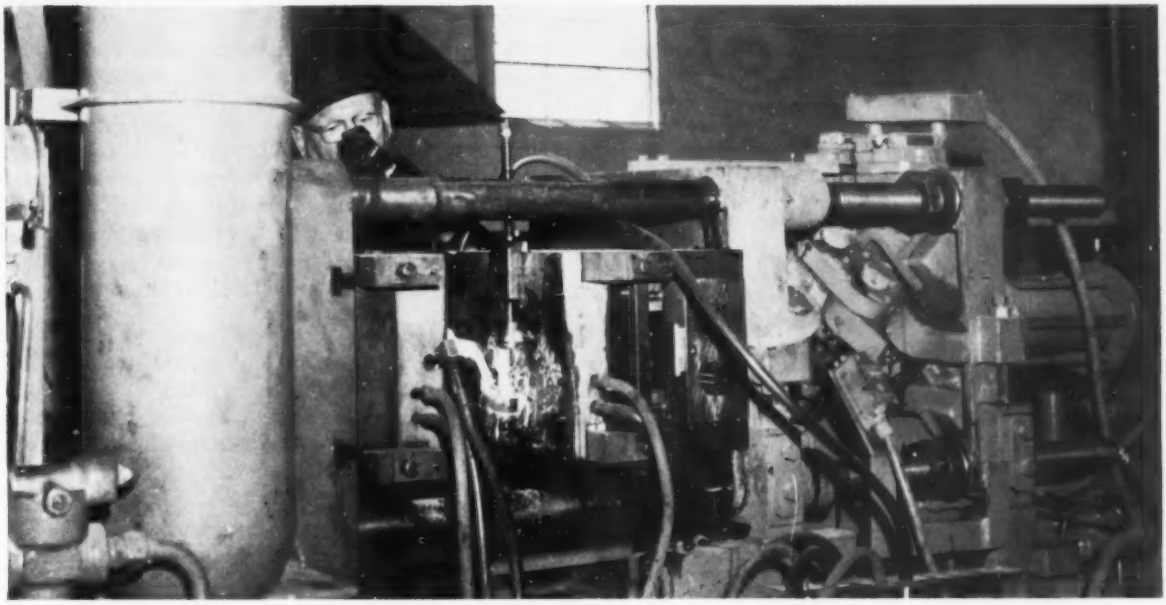
CHANGE DIES IN MINUTES!

With D-M-E Standard Unit Dies for Zinc or Aluminum Die Casting



Cut Die Costs and Save Time with Stock Replacement Units

DIE CHANGES that normally take 3 to 5 hours are done in minutes with D-M-E's Standard Unit Dies for zinc or aluminum die casting.

Standard interchangeable Replacement Units are *in stock* now to reduce your die costs and shorten delivery schedules.

D-M-E's Standard Unit Die assembly offers these unique features for added savings in production time and maintenance:

Construction permits complete freedom on *three sides* of the cavity for placement of cores or cooling lines; six sturdy leader pins and bushings provide accurate alignment and trouble-free performance; and "quick change" wedge clamps for positive positioning of each plate.

Standard Replacement Units are quickly positioned in the Unit Die Holder by a precision T-slot in the mating edge of the plates; there is no interference with the cavity layout.

Whether you require rack and pinion or automatic "bumper-type" ejection, D-M-E has a Standard Unit Die to fit the machine.

D-M-E Unit Die Holders are available for Standard 10" x 12" or 12" x 15" Replacement Units.

Start saving *now* on your short-run die-casting jobs with D-M-E Standard Unit Dies.

SEVEN BRANCHES FOR FASTER SERVICE

Write **TODAY** for Complete Specifications

DETROIT MOLD ENGINEERING COMPANY

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New SPECIALIZED

Harbison-Walker Refractories meet the intensified conditions of today's aluminum industry

Within the last couple decades the production of aluminum metal in the United States has trebled and the number of its alloys has increased manyfold. Rapid evolutionary developments created the need for refractories to meet new conditions. The severity of corrosion, more destructive impact accompanying furnace charging and the necessity of avoiding contaminants for meeting rigid alloy specifications—these among other factors have become increasingly important.

Since the first commercial production of aluminum and its alloys, Harbison-Walker brands, primarily of alumina-silica and high-alumina compositions, have continued to fulfill the ever-growing demands. Through unceasing research several refractories, recently developed specifically for aluminum melting furnaces, possess definitely superior properties for maximum durability and best quality of metal. Harbison-Walker's CORALITE XX (85% alumina brick) has established excellent service records in aluminum furnace bottoms and side walls. Several modifications with enhanced properties now are in commercial production.

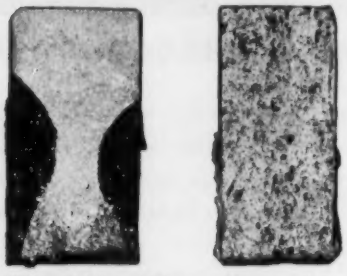
These unique refractories expecially suited for aluminum melting furnaces are here briefly described.

CORALITE 22-58 is a stabilized aluminum phosphate bonded brick containing approximately 85% alumina. It has exceedingly high strength and withstands greater impact and abrasion. Its resistance to wetting and penetration by the molten metal are properties of paramount importance. CORALITE 24-59 is the hard-fired variation, having still higher mechanical strength.

CORALITE 3-59 is a very hard-burned brick containing approximately 85% alumina. It is made with a special bond (patent pending) which contributes to its remarkable strength. As illustrated by the photograph showing results of the laboratory tests, it is exceedingly resistant to penetration and reaction with molten aluminum.

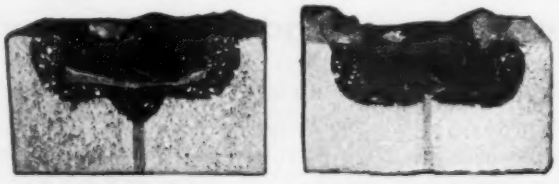
CORALBOND is a phosphate bonded high alumina mortar developed specifically for use in aluminum melting furnaces. Among numerous mortars of many compositions, CORALBOND is very outstanding in its resistance to penetration and corrosion by aluminum alloys at the furnace operating temperatures.

ALUMINUM IMMERSION TEST



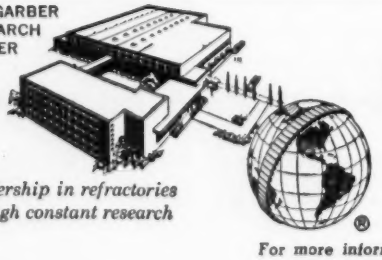
These brick, which were immersed in aluminum alloy at 1400°F. for nine days, show contrast in degree of penetration or wetting between a normal high alumina brick, left, and CORALITE 3-59, right.

MORTAR JOINT TEST



Photograph of Laboratory "Cup Tests" with molten aluminum alloy, shows striking difference in resistance to penetration and corrosion between a widely-used air-setting bonding mortar at the left and the CORALBOND joint at the right. Among many mortars of widely different compositions, CORALBOND—as illustrated in this test—is unmatched.

THE GARBER RESEARCH CENTER



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HARBISON-WALKER REFRACTORIES COMPANY

AND SUBSIDIARIES — GENERAL OFFICES: PITTSBURGH 22, PENNSYLVANIA

World's Most Complete Refractories Service

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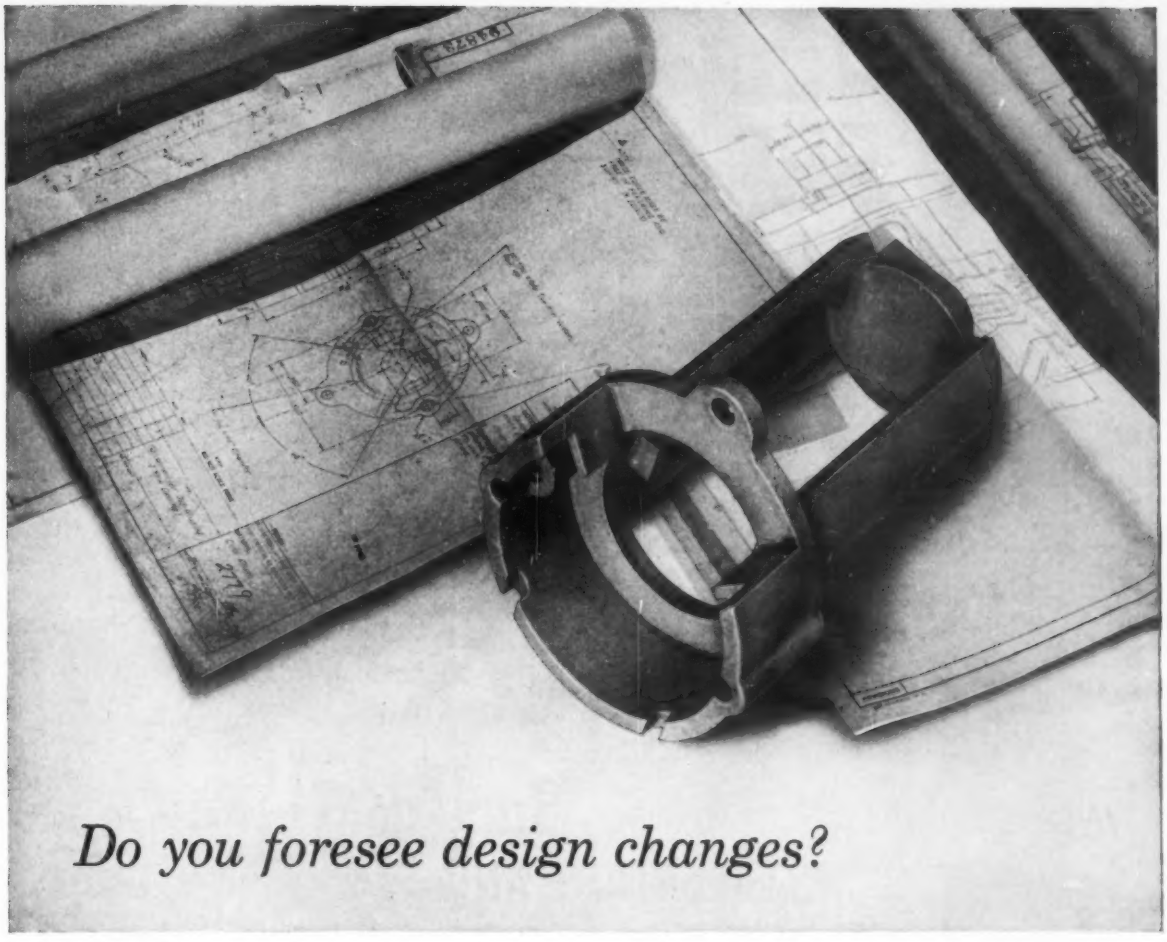

...ask Arwood about investment casting

Investment casting offers you just about the most inexpensive, convenient way you can find to get your new part from the drawing board to finished, production line quantities. This is especially true when your design may involve some degree of complexity... a strong, tough alloy... time-consuming machining steps ... expensive tooling.

There are good reasons. With investment casting, tooling is quick and inexpensive. It's easy to modify finished dies as the need for design changes develops. Even more important, Arwood will handle the whole job for you, from blueprints through to the finished part.

It makes no difference what metal or alloy you specify; Arwood casts a complete range of ferrous and non-ferrous materials. The skilled toolmakers at each of our four foundries can turn out fifty or more dies each week. So to save time and cut your costs between the drawing board and finished parts, ready for assembly, get in touch with Arwood.

Write today for your free copy of the new 44-page Arwood "Practical Guide to Investment Casting." It provides all the information you need to evaluate the technique and use it to help solve your design problems.

MACHINE THE SIMPLE... CAST THE COMPLEX

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ARWOOD PRECISION CASTING CORP., 323 W. 44th St., N. Y. 36, N. Y.

A complete service from design through tooling, production and finish machining. Sixty-two engineering consultants from coast to coast.

PLANTS IN BROOKLYN, N. Y.; TILTON, N. H.; BROTON, CONN. & LOS ANGELES, CALIF.

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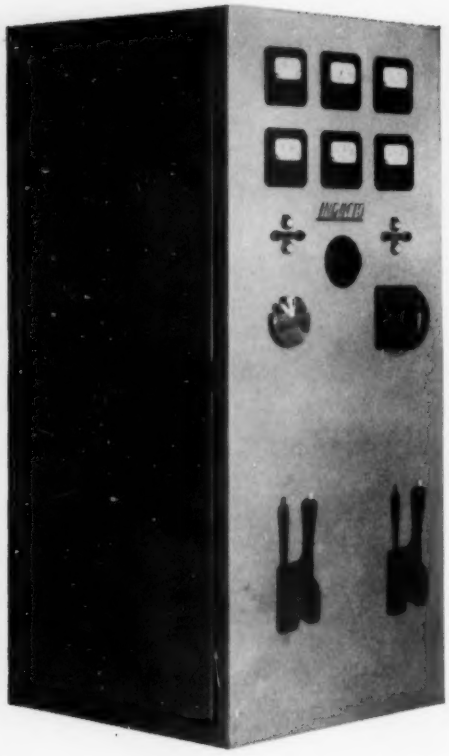
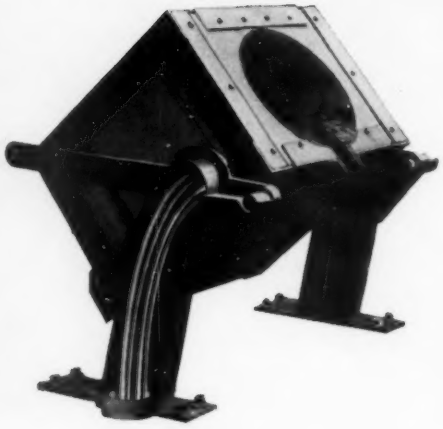


**INDUCTOMELTING is high-frequency induction melting PLUS the additional advantages of INDUCTO design features and engineering techniques.*



INDUCTOMELTING MEANS* Savings IN INSTALLATION AND OPERATING COSTS

From the moment your INDUCTO equipment is installed, you start saving money. And this saving continues for the life of the equipment.

The reason is simple. Inductotherm engineers have applied the advantages of modern design to the well-established principle of high-frequency induction melting. Take INDUCTO control cabinets, for instance . . . they are surprisingly compact yet they contain all the control, metering equipment, capacitors, transformers and selector switches necessary for the efficient operation of induction furnaces. We ship them completely assembled to keep installation costs at a minimum. Now . . . look at the furnaces. The exclusive INDUCTO power leads enter through the trunnion. No furnace pits are required. There's very little bus bar to buy and install because the runs are short. Installation time is minimized—an additional saving because you are in production faster.

How does INDUCTO equipment operate? Your men will find that it handles easily—effectively. Its high melting speeds and precise temperature control will soon show you how INDUCTO equipment often pays for itself in two to three years of operation.

The features which cut installation costs also contribute to operational savings. For example, the water-cooled furnace leads are specially constructed to handle high-frequency currents easily. Because they enter the furnace through the trunnion, they can be much shorter, thereby reducing electrical losses. The furnace selector switches, designed by Inductotherm engineers, are the most efficient of their kind. They are located on the lower front of the panel to provide a continuous current flow from the capacitors to the furnaces and to eliminate unnecessary bus bar. The high-frequency transformers, built to INDUCTO specifications, have an efficiency rating of 99.5%. In fact, every component reflects our successful efforts to achieve top operating efficiency. It all means better melting—INDUCTOMELTING!

These cost-saving features are detailed in our Bulletin 70 . . . send for your copy today. INDUCTOTHERM CORPORATION, 412 Illinois Ave., Delanco, N. J.

INDUCTOTHERM

. . . the mark of modern melting

For more information circle No. 28 on the Reader Service Card

after 30 years of serving the die casting industry in finishing we **NOW** offer you a complete die casting service

SEND FOR FREE BOOKLET

Take a tour of our modern plant by means of this well-illustrated booklet that shows our facilities for making and plating your die castings.

THE DISALLE PLATING & DIE CASTING CO, INC.
2851 SOUTH AVENUE • TOLEDO 9, OHIO

I am interested in learning more about your ability to produce and finish die castings for me. Please send me your photographic booklet showing your complete facilities without obligation.

Name _____

Title _____

Company _____

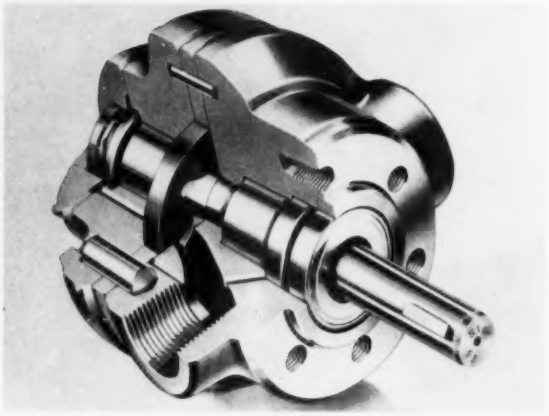
Address _____

City _____ Zone ____ State _____

For more information circle No. 17 on the Reader Service Card

NEW PRODUCTS AND DEVELOPMENTS

Want complete details on these announcements? Use the Reader Service Cards. You'll find them facing page of this issue



PUMP FOR FIRE-RESISTANT FLUIDS

The Series 800, is a new line of Gerotor Pumps designed for use with fire-resistant fluids. Developed by BROWN & SHARPE MFG. CO., the pumps have been use tested with proprietary water-soluble-oil emulsions, both regular and inverse; ethylene glycol-water mixtures; phosphate ester types and high temperature MIL fluids.

The pumps are available from stock in 3,5,8, and 12 gpm sizes in QDH-830 Single Pumps; 20,30 and 40 gpm sizes in OG-860 Single Pumps; and in any combination of 3,5,8, or 12 gpm in QGH-H-830 Double Pumps.

All of the pumps are dimensionally interchangeable with regular Gerotor oil-hydraulic units of comparable capacities.

Circle No. 235 on Reader Service Card

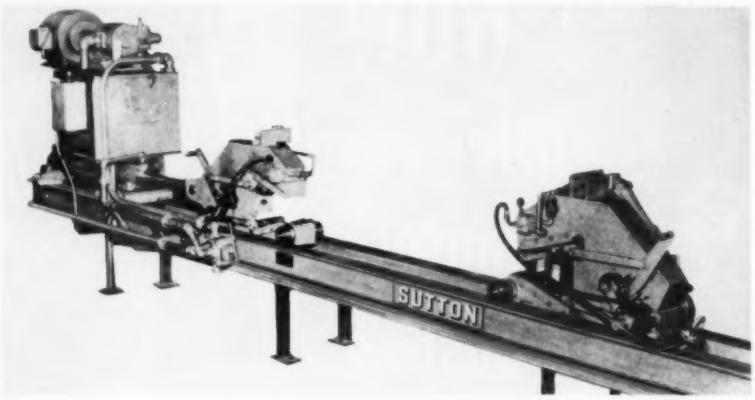
HIGH SPEED HYDRAULIC STRETCHER FOR EXTRUDED SECTIONS

This 20-ton hydraulic stretcher has been developed by SUTTON ENGINEERING CO., for stretch-straightening of extruded sections of aluminum and other modern metals.

The unit features a vertical jaw design which provides a horizontal pass line through the head and tail stock for ease of material handling. Extrusions of up to 100 feet long can be handled at high rates of production up to a 20-ton pull. At less than 6 tons pressure, higher speeds up to 400 inches per minute can be realized. Length of stroke of the head stock is 48 inches.

The air-operated jaws are easily interchangeable for different shapes. The tail stock is adjustable for different lengths.

Circle No. 236 on Reader Service Card



AUTOMATIC POLISHING MACHINE FEATURES FLEXIBILITY

The ACME MFG. CO. has developed a line-type universal straight-line automatic polishing machine that features maximum compactness and operation flexibility for high production parts.

The machine consists of an in-line conveyor that moves one-foot long cast iron platens around the periphery of the unit. Feed rates are from 4 to 29-ft per minute. The conveyor is made up of standard 4½-ft sections. Platens are spaced one-ft apart. Work is loaded and unloaded from the work spindles at the end of the machine. The platens can be driven continuously or indexed from station-to-station.

Circle No. 237 on Reader Service Card

continued on page 65

# of American Zinc...

for America's Industrial Future

Development work conducted recently in our Tennessee properties indicates that American Zinc has more than a half-century's supply of zinc concentrates underground. This is a conservative estimate based on an increased production rate over that of the present.

These proven reserves in our Tennessee mines are some of the largest known in the United States. This proven supply of raw material assures galvanizers, die casters and brass makers, as well as users of zinc oxide, of ample supplies of zinc from American Zinc's mines for at least the next 50 years.

With 60 years of service to American Industry behind us, we stand prepared for the next half-century ahead.

American Zinc sales company

Distributors for AMERICAN ZINC, LEAD & SMELTING COMPANY

COLUMBUS, OHIO • CHICAGO • ST. LOUIS
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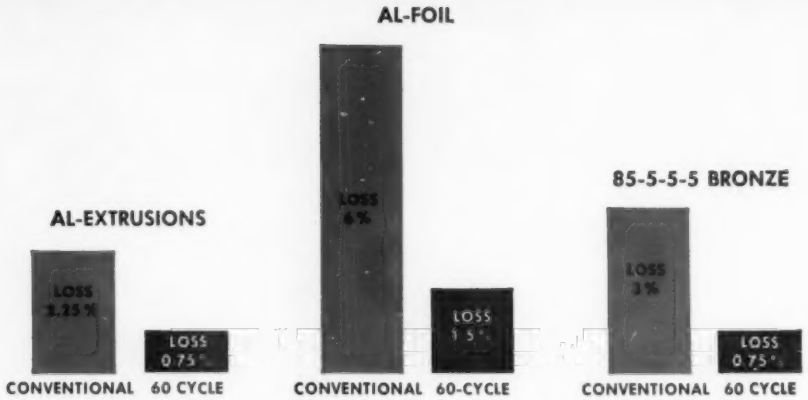
For more information circle No. 6 on the Reader Service Card

60 CYCLE INDUCTION MELTING *SAVES* Metal and Money

METAL LOSS REDUCED



A sharp cut in metal losses is inherent in 60 CYCLE INDUCTION MELTING. Unnecessary metal losses in a furnace can amount to many thousands of dollars per year. Here are three examples of what AJAX 60 CYCLE INDUCTION furnaces have done for others:

ALUMINUM EXTRUDERS: Typical experience of manufacturers of aluminum extrusion billets using AJAX-TAMA-WYATT 60 CYCLE INDUCTION furnaces is a metal loss of 0.75% as compared to 2.25% in conventional fuel fired furnaces. (Based on a charge containing 30-40% extrusion scrap.)

ALUMINUM FOIL MILLS: 60 CYCLE INDUCTION MELTING furnaces are widely used to melt foil scrap and other finely divided materials. Operating reports show a reduction from 6% metal loss in conventional furnaces to 1½% in the coreless AJAX-JUNKER furnace.

BRASS AND BRONZE FOUNDRIES: AJAX melting furnaces are standard in all brass millcasting shops, because metal losses with other methods are prohibitive. More recently, special AJAX-TAMA-WYATT furnaces have been applied widely to 85-5-5-5 bronze casting. Here the metal loss is under 1%, as compared to 3% or more in externally heated furnaces.

IN ALL THESE CASES, SAVINGS PAID FOR THE EQUIPMENT IN LESS THAN TWO YEARS.

60 CYCLE INDUCTION MELTING has many other important advantages. Our engineers will be glad to analyze your requirements. Please write to AJAX ENGINEERING DIVISION, P. O. Box 1418, Trenton 7, N. J.

Induction Heating is our ONLY Business

Ajax Magnethermic CORPORATION

GENERAL OFFICES

AJAX ELECTROTHERMIC DIVISION
Ajax Park
Trenton 8, New Jersey

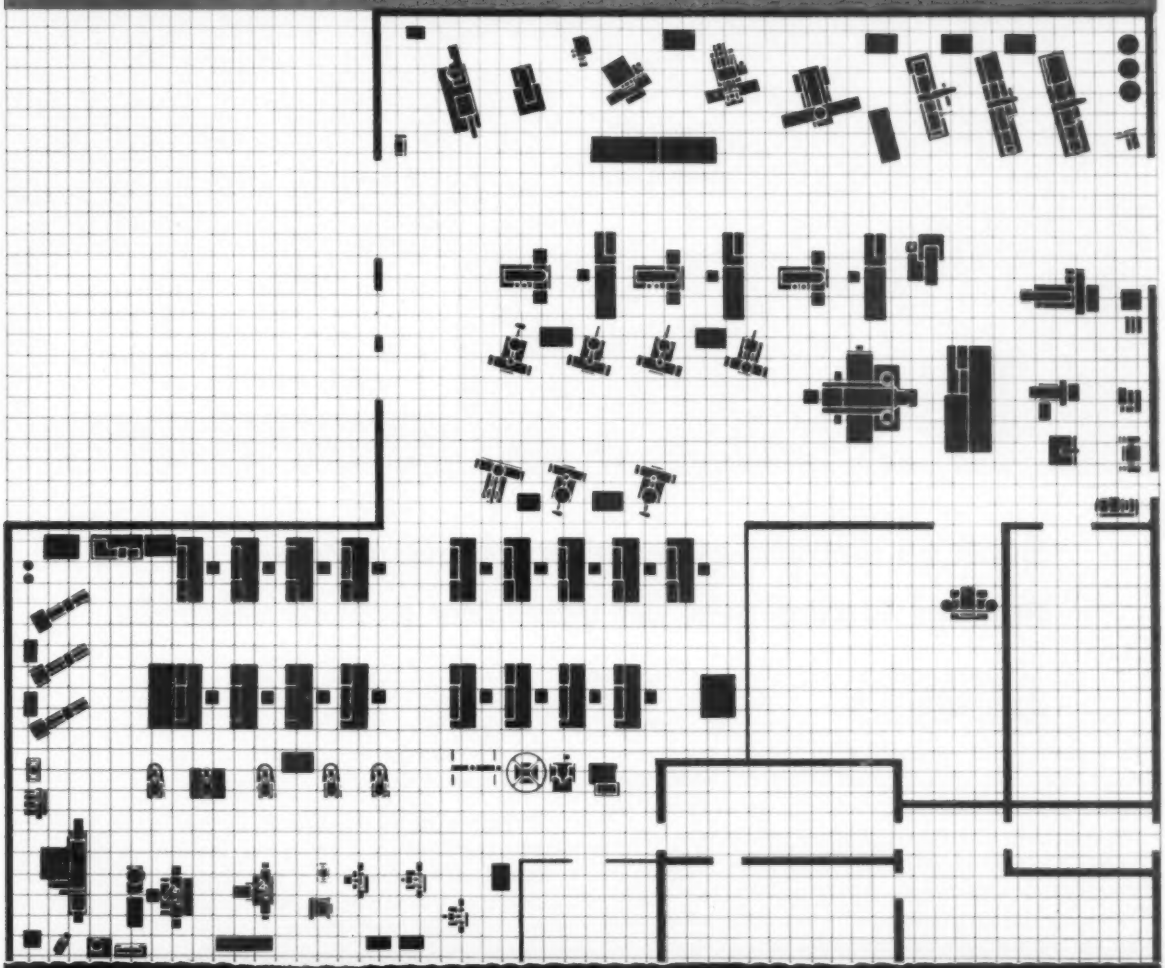
MAGNETHERMIC DIVISION
P. O. Box 839 • 3990 Simon Road
Youngstown 1, Ohio

AJAX ENGINEERING DIVISION
P. O. Box 1418 • Lalor & Hancock Streets
Trenton 7, New Jersey

For more information circle No. 9 on the Reader Service Card

WE HAVE Taken the roof off!

Because there's no better way to show you our exceptionally well equipped shop for making DIE CASTING DIES!

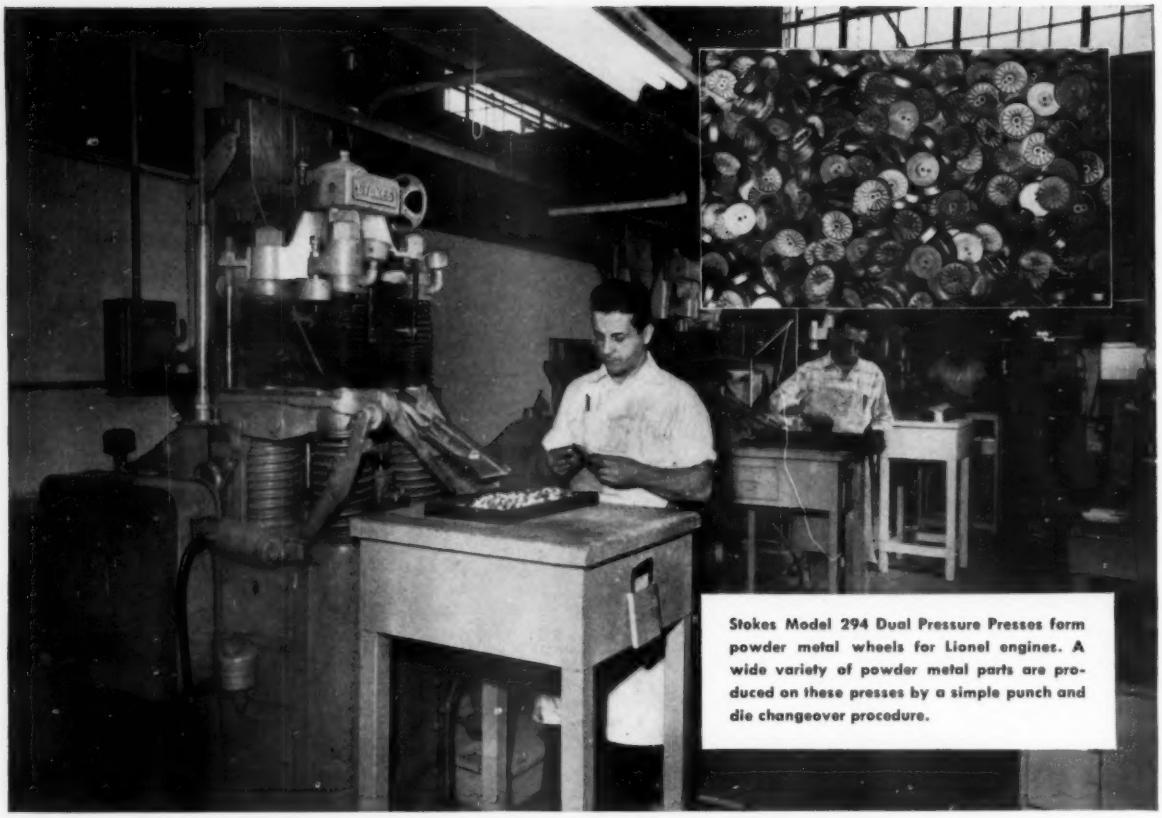


ZUELZKE offers you a combination of highly skilled personnel and long experience in mold making. Complete design and engineering service. Phone, come in, or write for more information.

ZUELZKE TOOL & ENGINEERING CO. INC.

TELEPHONE HOpkins 6-0260 • 6201 North 39th Street, Milwaukee 9, Wisconsin

For more information circle No. 47 on the Reader Service Card



Stokes Model 294 Dual Pressure Presses form powder metal wheels for Lionel engines. A wide variety of powder metal parts are produced on these presses by a simple punch and die changeover procedure.

Stokes precision presses help Lionel model trains run on powder metal wheels

The name Lionel is synonymous with enjoyment to boys of every age. Since 1900, Lionel has manufactured hundreds of thousands of model train sets. In an effort to increase quality and reverse rising cost trends, Lionel purchased a battery of Stokes Powder Metal Presses several years ago to form many of the trains' parts. Today, over ½ million parts are produced each day on Stokes precision presses.

For example, Stokes presses form iron car wheels from powder metal. Unlike machine punched wheels, powder metal wheels are heavier. They lower the train's center of gravity and give it added stability. Finished wheels are more uniform and realistic. What's more, powder metallurgy has reduced wheel costs over 40%.

Perhaps powder metallurgy can cut your costs and save metal over conventional machining methods. It can aid you in getting properties of metals, alloys and mixtures unobtainable through other methods. And Stokes can help you determine production costs . . . handle complete laboratory production for sampling . . . include design and fabrication of punches and dies . . . and recommend types of equipment. Why not look into it further. Give Stokes a call . . . today.

Tabletting Division
F. J. STOKES CORPORATION
5500 Tabor Road, Philadelphia 20, Pa.

STOKES

For more information circle No. 44 on the Reader Service Card

VISCOUNT 44 pays off here!

Prehardened, machinable H-13 Hot Work Steel saves heat treat time on extrusion tooling!

Extrusions shipped up to 48 hours faster? Certainly! . . . when you eliminate heat treat time on extrusion dies, backers and bolsters. Not only do you gain time but you are certain of "clean" metal at bearing surfaces . . . metal free of surface decarburization sometimes resulting when finished tooling is heat treated.

Practical to machine? Certainly! . . . even though Viscount 44 is furnished prehardened at Rockwell C44-46, it is readily machinable.

Other extrusion die steels made by LATROBE

Metalmasters

to exacting standards . . .

LPD Type H-12

VDC Type H-13

VISCOUNT 20
Free machining Type H-13

A wide range of Viscount 44 sizes is available near you. Call Latrobe today! . . . or send for this bulletin!

LATROBE STEEL COMPANY
LATROBE, PENNSYLVANIA

MEMBER OF AEC ALUMINUM EXTRUDERS COUNCIL

BRANCH OFFICES and WAREHOUSES: BOSTON • BUFFALO • CHICAGO • CLEVELAND • DAYTON DETROIT • GRAND RAPIDS • HARTFORD • LOS ANGELES MIAMI • MILWAUKEE • NEW YORK • PHILADELPHIA PITTSBURGH • TOLEDO • SAN LEANDRO • YOUNGSTOWN

For more information circle No. 32 on the Reader Service Card

Broader design application! Fast, efficient service! Increased output at lower cost! That is what you get when you specify that PMD handle the tooling for your extrusions. At PMD no job is too big, or too tough. We specialize in all types of extrusion dies and tools: Solids, porthole, bridge, mandrel, etc.

PROMPT SERVICE—PMD is staffed and equipped to get your die to you when you need it.

CAST EXTRUSION DIES—are now available at PMD, for extruding brass, copper, steel alloys, and rare earth metals. Leading extruders agree that these cast dies have longer life and give them closer tolerances, better performance, lower tooling costs.

PMD EXTRUSION DIE COMPANY

5747 Beebe Avenue, Warren, Michigan • COngress 4-2518 (Detroit)

Associate Companies: Permanent Mold Die Co., Inc.; Permanent Machine Div., Piston Mold Die Co.

For more information circle No. 39 on the Reader Service Card

PMM LETTERS

the readers' forum

BACK ISSUES

On taking stock of our holdings of PRECISION METAL MOLDING, our Technical Library discovered that we are missing certain issues of that title. As we are attempting to establish as complete a file as possible of PRECISION METAL MOLDING in the form of bound volumes, this is to request that we obtain any or all of the issues listed below.

Any or all issues previous to Vol. 12, No. 8.

Vol. 13, No. 6; Vol. 15, No. 12; Vol. 16, No. 3 and Nos. 5 through 10. – W. B. Serials Librarian.

As many of the back issues as are still available have been sent. – ed.

DIRECTORIES

We have your June issue which includes a directory of the Investment Casting industry. We have also seen previous issues in which similar directories have been included.

Would you advise if a directory on shell mold castings has ever been published in your magazine? If so, we would like to obtain a copy. –J.P.,Jr.

Sorry, we do not publish a directory of the shell mold casting industry. –ed.

ELECTRON BEAM MELTING

I desire a copy of the proceedings of the Electron Beam Melting Symposium mentioned on page 10 of the June issue of PRECISION METAL MOLDING. Can you tell me if copies are available and if so where? –W. T. Magnetic Head Eng.

Copies of the proceedings of this symposium may be obtained from the Alloyd Research Corp., 202 Arsenal St., Watertown, Mass.–ed.

BOOK ON DIE CASTING

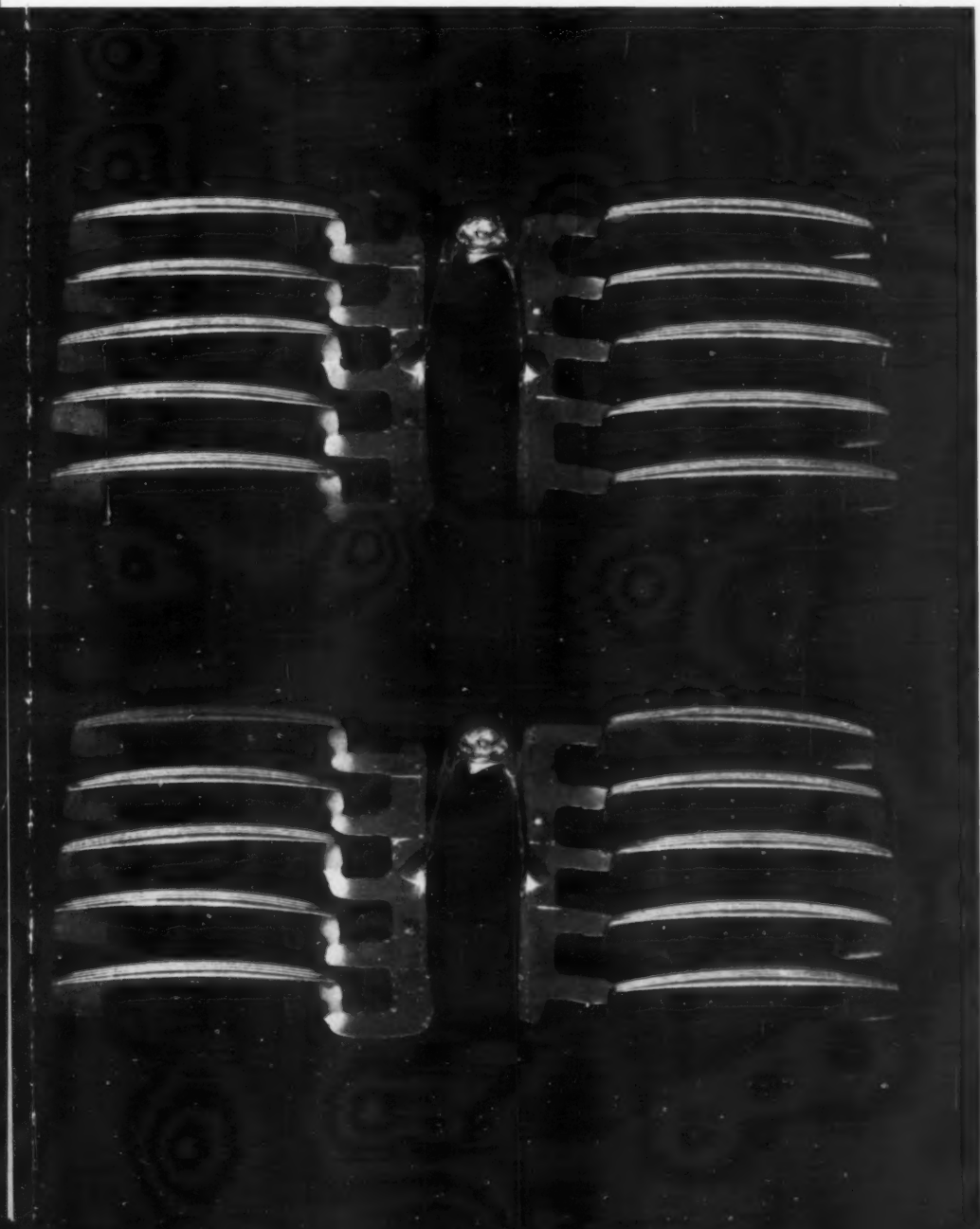
We saw an article in the June issue of PRECISION METAL MOLDING on a technical manual published by the American Charcoal Co.

continued on page 23

Circle No. 5 on the Reader Service Card

Completely controlled production provides you with die cast metals of highest purity and uniformity. Federated Di-Metal is made from special high grade zinc, electrolytically refined by Asarco-developed processes. Production is now concentrated "under one roof" at Corpus Christi, Texas, one of the world's largest plants producing special high grade zinc. Integrated production—controlled from mine to finished alloy—assures you of lower cost Zinc Di-Metal of the highest purity and uniformity. Federated can serve your Di-Metal needs through 22 sales offices throughout the country. There's one near you. Federated Metals Division, 120 Broadway, New York 5. In Canada: Federated Metals Canada, Ltd., Toronto and Montreal.

FEDERATED METALS DIVISION OF



ASARCO

AMERICAN SMELTING AND REFINING COMPANY

THESE SINTEEL® POWDERED METAL PARTS FOR 1959 AUTOMOBILES

save production time lower costs and improve product performance

This two unit assembly, produced by the American Sinteel Corporation, is the control mechanism used on the reclining seats of a 1959 automobile. It is an excellent example of how a multitude of desirable features can be incorporated into a powdered metal part.

This pump rotor with its seven "slippers" is employed in the automatic transmission of an automobile. Because of its complex design, it was a difficult and costly part to produce by conventional methods. American Sinteel engineers were able to solve the problems involved and now the part is being produced on a production basis at a low unit cost.

Low cost, high speed production, close tolerances and unusual design possibilities are among the many advantages of Sinteel powdered metal parts. There are literally thousands of applications, including such products as gears, cams, complex nuts and fasteners, special purpose filters and structural members from steel, iron, brass and copper alloys, where Sinteel powdered metal parts can improve the performance of products now being made by other, more expensive methods of manufacturing. Powdered metal parts are available with many special characteristics, including self-lubrication, controlled porosity for infiltration and good electrical and magnetic properties for pole pieces, armatures and cores. Whatever your product requirements are, American Sinteel Corporation can produce precision parts to your specifications at substantial savings.

For more information on Sinteel ferrous and non-ferrous powdered metal products, send for your free copy of Engineering Bulletin #3020. It contains valuable information on Sinteel alloys and designing for Sinteel powdered metal products. ▶

SINTEEL®

AMERICAN SINTEEL CORPORATION

39 SAW MILL RIVER ROAD, YONKERS, NEW YORK

A SUBSIDIARY OF MUELLER BRASS CO.

For more information circle No. 3 on the Reader Service Card

LETTERS

continued from page 20

We would like to secure a copy of this manual and would appreciate your advising the writer how he may obtain it.—F.J.S. plant mgr.

The book called "A Visit With 500 Die-Casters" is to be published by the American Charcoal Co., 201 S. Green St., Detroit, Mich.—ed.

ICI STANDARDS

We are anxious to obtain a copy of the Investment Casting Institute's standards manual. Will you please advise us of the address.—H.W.R., Asst. Chief Inspector.

The address of the Investment Casting Institute is: 27 E. Monroe St., Chicago 3, Ill.—ed.

ADDRESS PLEASE

In the December, 1957 issue of PRECISION METAL MOLDING there was an item about "Shel-Cote" developed by the Chem-Cote Co. We have been unable to find the address of this company. Could you furnish us with the correct address. J.T.W., plant mgr.

The correct address of the Chem-Cote Co. is 5644 S. Christiana Ave., Chicago 29, Ill.—ed.

DIE CAST ROTORS

Will you please send us the names of several die cast machine manufacturers who make machines for die casting of rotors for electric motors. Our rotors are in the size range of 2½" in diameter by 3½" long up to 3" in diameter by 9" long. — A.C.W., vice pres., mfg.

The names of several companies who can make such machines have been sent.—ed.

D-C CASTING

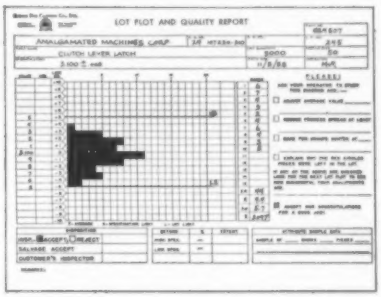
On page 38 of the June issue of PRECISION METAL MOLDING there is an article on D-C casting of copper and copper alloys. The Lobeck Casting Processes, Inc. is mentioned in this connection and I would like very much to contact this firm. Will you forward their address. — H. B., pres.

The address of Lobeck Casting Process, Inc. is 114 E. 32nd St., New York, N. Y.—ed.

For more information circle No. 45 on the Reader Service Card

STROH INTRODUCES
STATISTICAL QUALITY CONTROL
FOR DIE CASTINGS

DIMENSIONAL CONTROL
AT STROH DIE CASTING
BEGINS WITH A CHART
LIKE THIS . . .



Here's what the new concept of Quality Control at Stroh Die Casting means to you

CRITICAL DIMENSIONS
can be held within specified limits. Buyers who rely on statistical dimensioning to assure accurate parts for assembly are invited to consult Stroh.

LOWER INSPECTION COSTS
come from simpler receiving inspection instead of full sampling of each shipment of die castings. Many manufacturers now benefit from Stroh's Quality Control.

Write for Details

IN OUR 56th YEAR

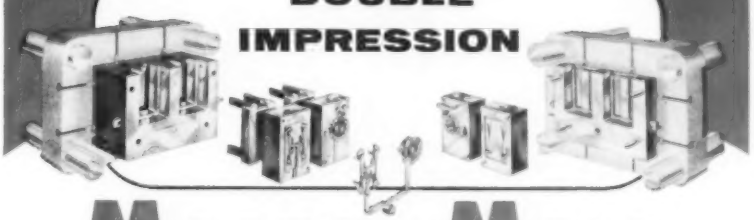
Stroh Die Casting Co., Inc.

11123 WEST BURLEIGH STREET
MILWAUKEE 10, WISCONSIN

shoot in the lower position! mold vertically!

RICHARDS

DOUBLE IMPRESSION



MASTER-MOLD

for aluminum and zinc die casting

It's here now — vertical position, double-impression molding. With Richards Master-Mold, either or both molds can be changed *in minutes*, from the top, with eye bolts and regular hoisting equipment. Eliminates manual handling of hot molds, saves time — speeds production.

Write for full particulars and prices on Richards Vertical Position Master-Molds and cavity blocks.

RICHARDS TOOL AND MOLD COMPANY
2715 LATHROP AVENUE • RACINE, WISCONSIN
107

For more information circle No. 62 on the Reader Service Card

Casting research on 17-4PH increases elongation 10% . . . costs Cannon-Muskegon customers nothing ¶ Cannon-Muskegon research has developed certain procedures for investment casting of 17-4PH that assure, consistently, the high level of properties which this alloy is capable of producing. ¶ Casting test bars in a keel block arrangement as shown here—rather than an end-gated arrangement—is one of them. Special recommendations on aging time and temperature are another. ¶ Further, Cannon-Muskegon research has demonstrated the necessity of stricter limits to provide a balanced chemistry and prevent harmful effects induced by too high or too low a content of certain elements. Keeping within these limits and following Cannon-Muskegon recommendations assures investment casters of consistently obtaining optimum performance from this fine alloy. ¶ We invite you to write for a free copy of the ICI Technical Research Report, "The Effect of Aging Time and Temperature on the Mechanical Properties of Investment Cast 17-4PH."

MASTERMET
AIR-MELTED ALLOYS

CANNON-MUSKEGON CORPORATION
Metallurgical Specialists • 2871 Lincoln Street • Muskegon, Michigan

For more information circle No. 13 on the Reader Service Card

These refractory shapes

stay strong up to 3000°F —are not wet by aluminum

REFRAX® silicon-nitride-bonded silicon carbide refractory looks like a metal, can be formed into shapes formerly possible *only* with metals—yet gives results far superior to most metals. Non-wetting by molten aluminum, for example, prolongs refractory life because dross can't penetrate or adhere. And processes like die casting and aluminizing, which used to operate intermittently because some parts corroded, can now be run continuously.

Iron nozzles for handling molten aluminum are an example. The aluminum causes them to cut out in an hour, or even less. But REFRAX nozzles in the same application often last for as long as *several hundred* hours.

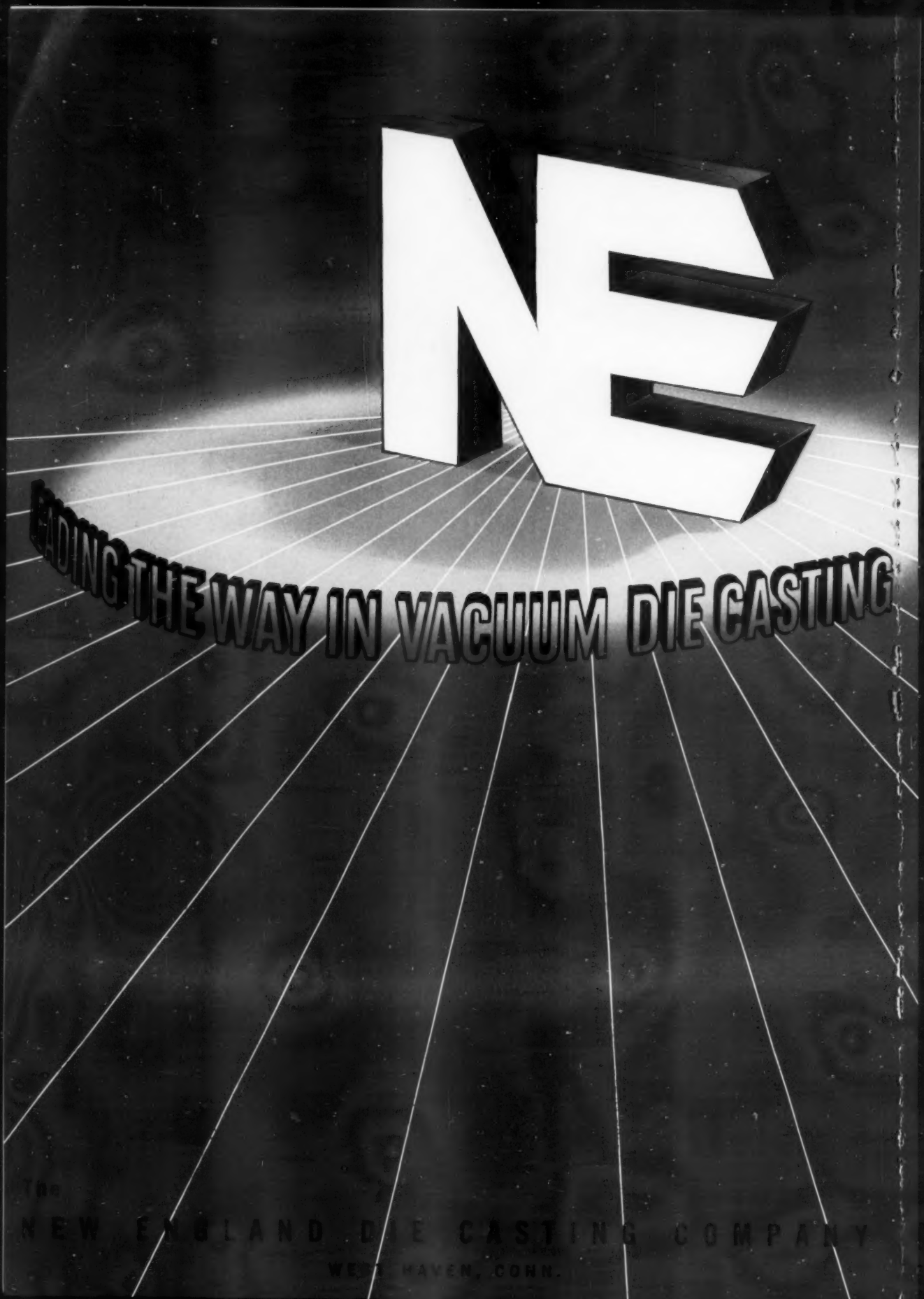
REFRAX parts are not affected by most acids, even corrosive slags and highly-reactive materials. They're also highly resistant to abrasion and heat shock—and retain virtually all of their properties up to, and occasionally beyond, 3000°F.

If you work with aluminum holding or alloying furnaces, (including reverberatory and induction), or could use these properties for other applications, it will pay you to write for complete information from: Refractories Division, The Carborundum Company, Perth Amboy, New Jersey. Please address: Department [illegible].

CARBORUNDUM

Registered Trade Mark

For more information circle No. 14 on the Reader Service Card


NE
LEADING THE WAY IN VACUUM DIE CASTING
THE
NEW ENGLAND DIE CASTING COMPANY
WEST HAVEN, CONN.

Costing 25% less, here's how . . .

Sintering Meets Victor's Exacting Demands

IT TOOK four years of development before Victor Adding Machine Co. was satisfied with an accumulator wheel used in its calculators and multipliers. This part, although small, does an extremely important job in the accurate operation of these office machines. It serves a memory function, remembering figures which are put into the machine.

Two tiny lugs on the accumulator wheel, plus the fact that close tolerances were required, made it a troublesome part to produce. As made originally, the wheel was costly, difficult to machine, and scrap losses were high. These operations were formerly done:

- Blank (screw machine).
- Hob.
- Mill.
- Counterbore.
- Barrel finish.
- Cadmium plate.

The initial cost was about $.23 each. After investigating other sources of supply, and subsequently changing vendors, the cost was reduced to $.12 each.

Today, this same part, now sintered by Supermet Div., Globe Industries, Inc., costs $.09. This represents a saving of 25% over the best price available by the former process.

OUTSTANDING SINTERING

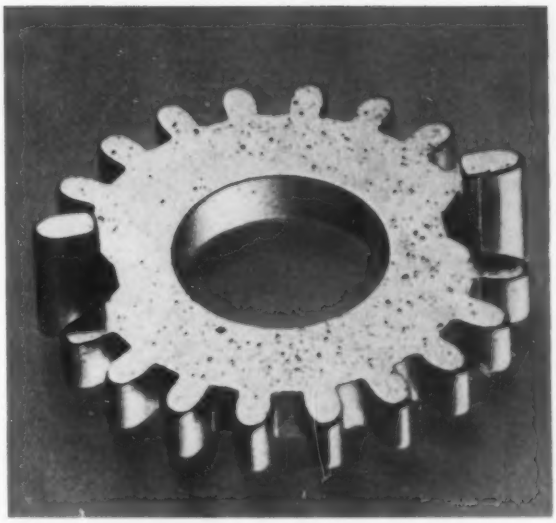
Considering all factors, the accumulator wheel is an outstanding example of what can be done with powdered metal. For instance, the total composite error (all possible errors in tooth shape, depth, concentricity, diameter, etc.) when measured against a master gear is held within ± .0015 in. Furthermore, the two tiny lugs on the wheel must be able to support a static weight of 60 lb.

The wheel, which has a pitch diameter of .500 in. also requires these close tolerances:

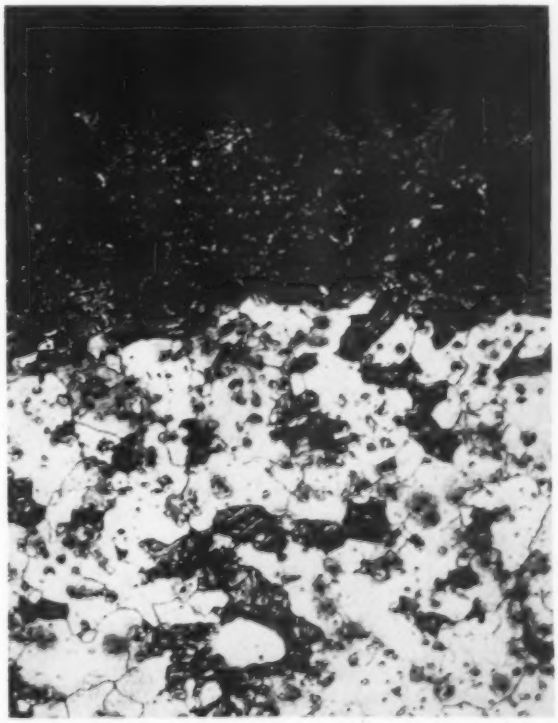
- Width, ± .0015 in.
- Hole diameter, ± .001 in.
- Lug thickness, ± .002 in.

Twenty-two of these wheels are used in each machine, in two registers of 11 each.

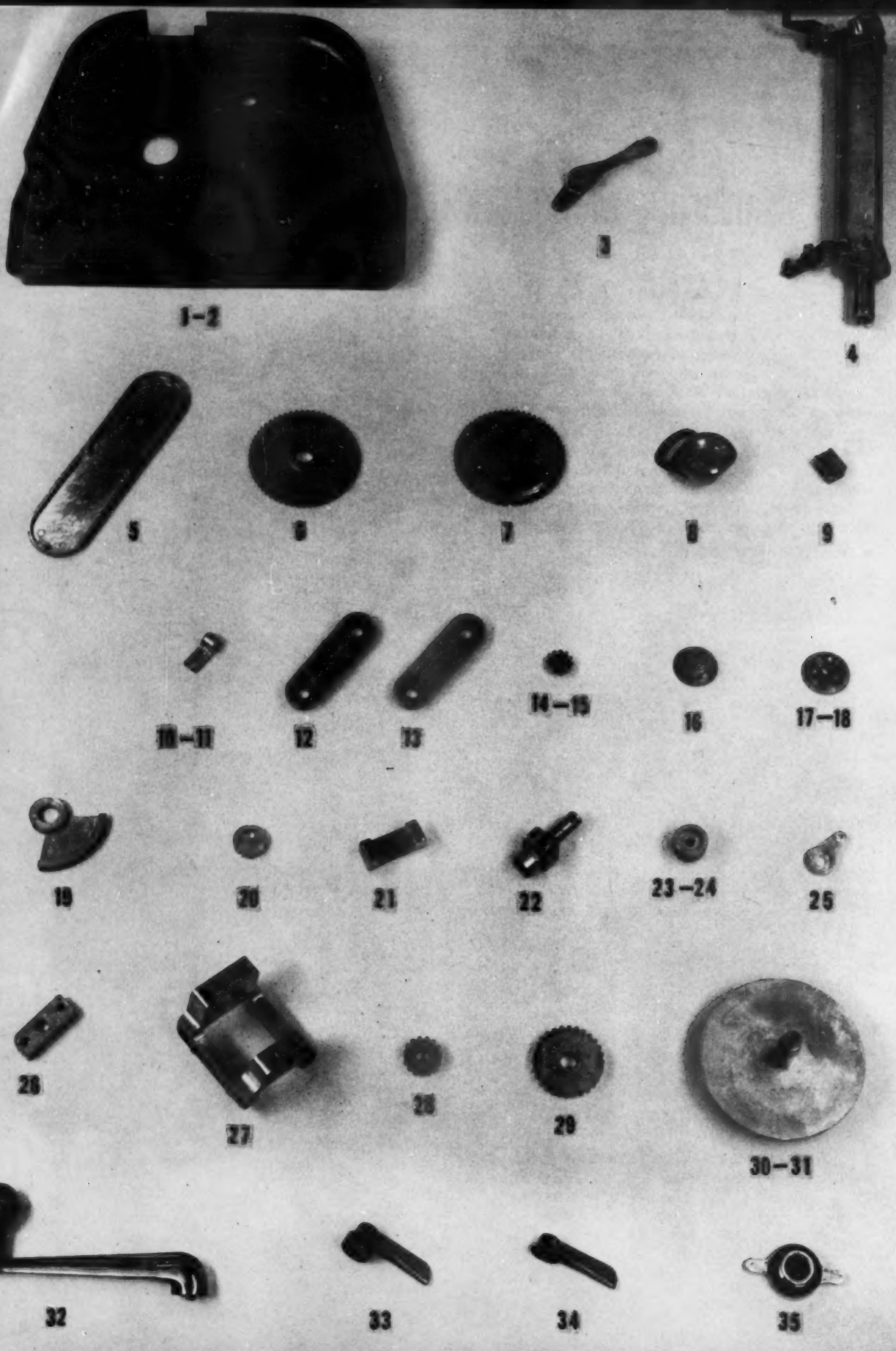
The wheel is made of powdered iron, impregnated with oil, and compacted to a density of 7.0 to 7.3% of theoretical. The sintering is sized to the close tolerances and barrel finished to remove sharp edges. It is atmosphere hardened to 60 points of carbon and oil quenched. Case depth is .005 to .008 in. Apparent surface hardness is Rockwell C-60 to 65, checked with a Tukon tester.



TWO TINY LUGS made wheel difficult part to sinter.



PHOTOMICROGRAPH (200X) shows uniformity of case.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Die casting takes a big bow as . . .

Duplicating Machine Uses 35 Die Cast Parts

MENTION DIE CASTINGS to Henry P. Keil, engineer for Fixture Hardware Corp., Chicago manufacturing center for Copy-rite and Wolber Spirit Duplicators, and his eyes light up. Readily admitting that he's completely prejudiced in favor of these castings, Keil designed the company's duplicating machine, the Copy-rite, almost entirely of die cast parts. In fact, Keil holds 13 patents on mechanisms contained in this machine.

The machine, which has been on the market for about a year, reproduces typed or drawn matter by the spirit duplicating process. There are two models: one hand-operated and one electric-powered.

Keil's enthusiasm for die casting stems from a number of benefits offered by this process. Probably the most significant of these is the reduction in manhours required to make the machines. Years ago, when sand castings were being used on older versions, the company needed three times as many workers as they do today. And, with only a third as many workers, more machines are being produced.

In addition, close reproducibility of parts is maintained. There is much less breakage and scrap, and, of course, machining operations have been reduced drastically. In fact, few, if any, machining or other finishing operations are performed on most castings.

Combine all these factors and you can see why the Copy-rite sells at a moderate price.

ZINC DIE CASTINGS

These parts are die cast in zinc:

- *Sides.* Two sides are used on each machine, and each weighs about 5 lb. These are the largest castings on the machine, and closest tolerances are held to ± .002. Raised lettering is cast into one side. On one, 19 holes are drilled and 10 of them tapped; on the other, 19 holes are drilled, and 11 tapped. The sides are spray painted and baked to protect them from the methanol used in the duplicating process. Four bushings are inserted. These are bronze sinterings impregnated with oil, and must be accurate to ± .0015.

- *Operating Lever.* The operating lever, used to turn the machine on and off, formerly was a screw-machined part. It is now used as cast, except that one of its three holes is reamed.

- *Fountain.* The fountain, or fluid trough, holds the duplicating fluid. Only one finishing operation is required: Slots which hold the roller are cast with a taper, and this taper is removed by milling.

- *Cover Plate.* The cover plate has four pins cast in to fit holes cast into the sides, and dimensions must be held within ± .003. To secure the pins, they are spun in a drill press. This operation is used to avoid possible breakage of the pins by ordinary peening. A raised arrow is cast into the cover plate.

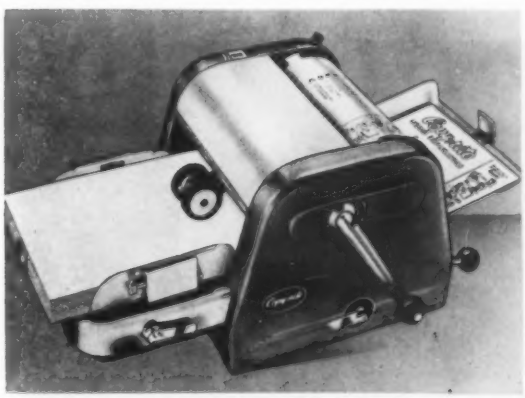
- *Driving Gear.* The driving gear, which is connected to the handle, makes it possible to rotate the cylinder by imparting a clockwise motion to the handle, one of the desirable features of the machine. Close tolerances are required, and the hole is reamed to ± .0005. This gear was test-run through 1½ million impressions and held up as well as a machined gear.

- *Driven Gear.* The driven gear is attached to the drum and is actuated by the driving gear. As in the driving gear, the hole is reamed to ± .0005. In addition, the cast-in screw holes are countersunk.

continued on next page

THESE ARE THE DIE CAST PARTS:

1, 2. Sides
3. Operating lever
4. Fountain
5. Cover plate
6. Driving gear
7. Driven gear
8. Cam
9. Clamp block
10, 11. Spring retainers
12, 13. Front feed housing
14, 15. Sprockets
16. Front feed drive disc
17, 18. Front feed hub
19. Front feed drive segment
20. Counter cam
21. Paper weight
22. Valve body
23, 24. Friction drive
25. Ball bearing container
26. Pressure roller adjustment bracket
27. Drive mount
28. Drive sprocket
29. Driven sprocket
30, 31. Drum ends
32. Handle
33. Feed tray lock lever
34. Copy intensity control lever
35. Tank cap



. . . AND HERE'S THE ASSEMBLED MACHINE.

• *Cam.* The cam is fitted to the drum shaft and has a pin cast in.

• *Clamp Block.* The clamp block fits on the master clamp which holds the original master on the drum. Close tolerances are required for proper clamping action, and the most critical dimension (wall thickness of a ridge) is held to ± .002. Three holes are cast in, and two of them are tapped. This block formerly was machined of steel, and it was difficult to hold dimensions within .002 in., resulting in high scrap loss. Furthermore, the die cast block holds up as well as the steel in performing its function.

• *Spring Retainers.* Two spring retainers are used, one on the right, the other on the left side. Three holes are cast in, and dimensions are held within .003 in. The zinc die castings are much less expensive than the brass retainers formerly used.

• *Front Feed Housing.* The front feed housing, which is a paper feeding device, is made of two die castings.

• *Sprockets.* Two sprockets, installed inside the front feed housing, are connected by a ladder chain.

• *Front Feed Drive Disc.* Grooves are cast into the front feed drive disc to keep a rubber ring from slipping. Tolerance is ± .002, and one hole is cast in. Another small hole is drilled for a retainer pin to hold the disc to the drive shaft. Chrome plating completes the finishing. The rubber ring is retained by a plate.

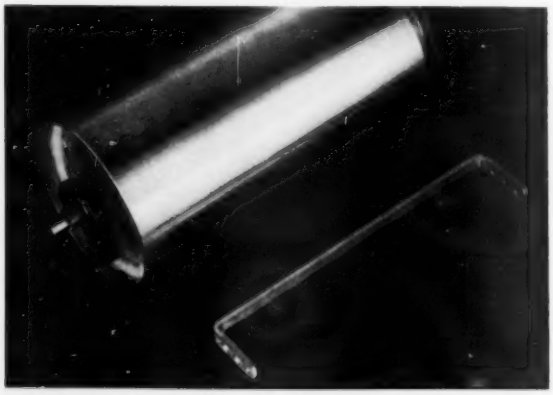
• *Front Feed Hub.* The front feed hub is made of two die cast halves onto which a rubber ring is fitted to feed paper into the machine. As in the front feed drive disc, grooves are cast in to prevent the rubber from slipping. Two holes are cast in each half.

• *Front Feed Drive Segment.* The amount of push that the front feed imparts to the paper being fed into the machine is timed by the front feed drive segment. One hole is reamed, two others are tapped.

• *Counter Cam.* The counter cam which activates the counter has one hole reamed, another drilled.

• *Paper Weight.* Cast-in teeth on the paper weight prevent paper from creeping forward in the machine. After casting, a hole is drilled, a pin force-fitted, and the part chrome plated.

• *Valve Body.* Flow of the duplicating fluid is controlled by the valve body, which permits flow when the machine is started, stops it when the machine is stopped. Four holes are cast in, one of them by means of a movable core, plus a slot.



DRUM, MASTER CLAMP are made of aluminum extrusions.

• *Friction Drive.* Two similar castings make up the friction drive, which is a patented device to change the relation between the copy and the master sheet. Used as cast, each section has a hole, groove, and serrated finish on the outside. Tolerance is ± .002.

• *Ball Bearing Container.* Used as cast, the ball bearing container holds the ball bearing for the drive shaft, and is screwed onto the pickup roller bracket through a hole. Tolerance is very close, ± .001.

• *Pressure Roller Adjustment Bracket.* A pressure roller adjustment bracket is used on each end of the roller, and it adjusts the printing pressure. It is cast with four holes and a slot, and a fifth hole is drilled.

The following three zinc die castings are used on the electric-powered model only:

• *Drive Mount.* The drive mount, which holds the worm, has 14 holes cast in.

• *Drive Sprocket.* Teeth on the drive sprocket must be cast with the smallest taper possible, and it's being held to ½°. Also, the tolerance on the teeth is very critical, since the timing belt will wear out quickly if it doesn't mesh almost perfectly with the sprocket. Thus, dimensions on the sprocket teeth must be within .0005 in. The sprocket is used as cast.

• *Driven Sprocket.* Except for being smaller, the driven sprocket is identical to the drive sprocket.

ALUMINUM DIE CASTINGS

Four parts are die cast in SC 114A aluminum alloy:

• *Drum Ends.* The ends which support the drum have steel inserts cast in.

• *Handle.* Two pins on the handle must be cast to the close tolerance of ± .001.

• *Feed Tray Lock Lever.* The feed tray lock lever which locks the paper guide has one hole cast in and three others drilled. One of the holes is tapped and the lever is polished. The lever formerly was made of plastic, which was unsatisfactory because of breakage.

• *Copy Intensity Control Lever.* The copy intensity control lever is made with the same die as the feed tray lock lever. The die is made with a die insert which is removed when this lever is cast. One hole is cast in, another drilled and tapped, and the lever is polished. Like the feed tray lock lever, it formerly was made of plastic, which was unsatisfactory.

One other die casting is used, a *tank cap* made of brass so the duplicating fluid won't act on it. It formerly was a sand casting. The cap is threaded, chrome plated, and an instruction plate cemented on.

ALUMINUM EXTRUSIONS

In addition to the die castings and sinterings, two aluminum extrusions are used:

• *Drum.* The drum, or cylinder, is extruded from 6063-T42 aluminum alloy with a wall thickness of 9/32 in. The outside surface is ground to a concentricity of ± .0005, and the ends are machined.

• *Master Clamp.* The master clamp which holds the original master on the drum is an extruded section 5/32 in. thick and ½ in. wide.

FIGURE 1. Internal soundness after heavy machining was needed in this housing.

How Lear uses . . .

Castings for High-Stress Applications

TWENTY-THREE separate operations are necessary to turn this permanent mold casting into a rotor housing for a gyroscope. It's expensive, but engineers at Lear, Inc. had sound reasons for specifying this method.

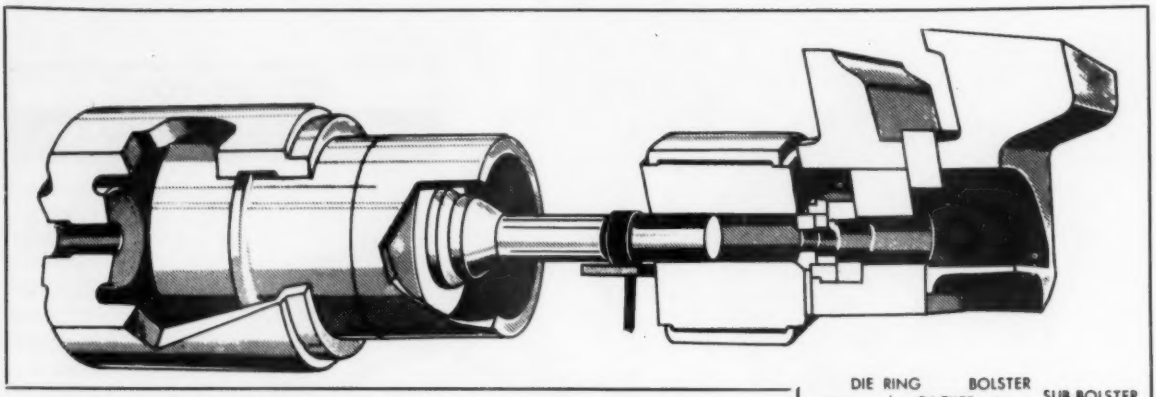
In operation, the spin motor of the gyroscope is located in the housing. It rotates at a speed of 23,000 rpm. While the motor is spinning, the housing tilts or rotates on its axes. As soon as the housing starts to tilt, the erection switch sends an electronic signal that returns the housing to its original position. This puts a severe strain on the housing, especially if the plane goes through fast maneuvering in flight. Also, there is a stress placed on the instrument from the high landing shock of high-performance jet aircraft. Then too, the housing is used in a family of instruments that in general are expected to withstand in the vicinity of 10 G's of acceleration in shock and/or vibration.

Instruments of this type usually require tolerances so critical that, regardless of the casting method used, detailed maching is necessary. The complex shape of the housing required that it be cast. Lear engineers had to decide which casting method could best meet the stress requirements of the part and at the same time eliminate as much machining as possible.

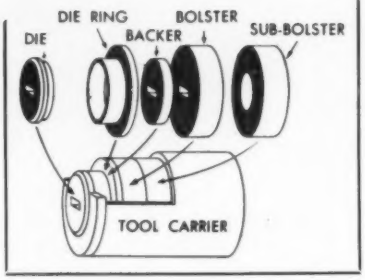
Sand casting the housing was ruled out for several reasons. First, the machined samples uncovered a great deal of porosity. This would have led to a high reject rate and the casting couldn't be counted on to meet the stress requirements. Second, sand casting would require even more machining than other casting methods because tolerances of ±.005 couldn't be held. It was finally decided that permanent mold casting would be the best and most economical method of casting the housing. Here's why:

- Superior metal structure. Permanent mold casting gave better part density.
- The complex shape required for the housing could be cast. Where machining is required on the permanent mold casting, far less stock has to be allowed than with sand.
- Accuracy. Tolerances of ±.005 could be held.
- Inexpensive tooling. In this particular case, the tooling required for permanent mold was the least expensive of all casting methods considered.
- Little porosity. It is rare to uncover porosity in a permanent mold casting when the chilled skin is machined away. This is important when you consider the amount of critical machining that has to be done on the housing.
- Short lead time for tooling. The molds for permanent mold casting usually require less modification to work satisfactorily. This is a cost savings. Also, on repeat orders, which was to be the case with this casting, all that's necessary is to bring the mold out of storage, degrease, and heat to the casting temperature.

continued on page 68



TYPICAL EXTRUSION PRESS is shown above, and die tool assembly is at right.



The causes and correction of . . .

Extrusion Die Failures

ALUMINUM extrusion dies seldom fail in services. Properly designed extrusion tools, made of the right grade of steel and heat treated correctly will usually last through the design life of the extrusion. But occasionally dies will fail.

Why?

What was the cause of failure and what is the correction?

Some of the answers to these questions have been furnished by the Crucible Steel Co. of America.

Before examining the types, causes and correction of failures let's set down the recommended steels, with appropriate hardness, for each extrusion tooling application (Table I).

TABLE I
RECOMMENDED STEEL & HARDNESS FOR ALUMINUM EXTRUSION TOOLING

TOOL	RECOMMENDED STEEL	HARDNESS ROCKWELL C
DIES	H-12	48/52
	H-13	48/52
BACKERS	H-12	48/52
	H-13	48/52
BOLSTERS	H-11	48/52
	H-12	48/52
	SAE 4340	48/52
DUMMY BLOCKS	H-12	46/48
	H-13	46/48
MANDRELS	H-12	48/52
	H-13	48/52
RAMS under 4250 tons	H-12	47/52
LINERS	H-12	40/44
	SAE 4340 (mod.)	40/44
CONTAINERS	SAE 4340	300/350 Brinell

Now assuming that the correct steel has been selected for each tool component we can set down the most probable types of tool failure. These are:

Dies — 1. Cracking
2. Caving
3. Tongue breakage

Backers — 1. Caving
2. Tongue breakage

Bolsters — 1. Cracking
2. Caving
3. Tongue breakage

While these are the most common types of tool failure there are many others: cracking, splitting, wash, loss of size, heat checking, upsetting, closing in, bending or pulling.

If tooling is over graded — that is, if too high an alloy steel is used — generally premature cracking, splitting or heat checking will result. If too low an alloy steel is used failure will generally be by closing in, pulling, loss of size, upsetting, bending, or wash. These latter failures indicate lack of red hardness.

The various types of possible tool failure, their probable cause and corrective measures are given in Table II.

TABLE II
EXTRUSION TOOL DIFFICULTIES
THEIR CAUSE & CORRECTION

TOOL DIFFICULTIES	PROBABLE CAUSE	CORRECTIVE MEASURE WITH RESPECT TO STEEL SELECTION
HEAT CHECKING	CARBURIZATION DECARBURIZATION	USE PROPER ATMOSPHERE
	HARDNESS TOO HIGH	CHECK CARBURIZATION TEMPER HIGHER TEMPERATURE LOWER CARBON STEEL CHECK HARDENING TEMPERATURE AND TIME
	HARDNESS TOO LOW	CHECK DECARBURIZATION TEMPER TO HIGHER HARDNESS CHECK HARDENING TEMPERATURE AND TIME
	EXPOSURE TO EXCESSIVE HEAT	CONSIDER COOLING DIES USE HIGHER ALLOYED STEEL
	EXCESSIVE INTERNAL STRESS	USE LESS DRASTIC QUENCH AIR COOLING FOR 5% CHROME HOT WORK STEELS & INTERRUPTED OIL QUENCH ON LOSS OF COLOR FOR HIGHER ALLOY TUNGSTEN & MOLYBDENUM BASE STEELS STRESS RELIEVE PARTICULARLY AFTER GRINDING, REHARDENING, WELDING OR HARD FACING OPERATIONS
	COOLING TOO DRASTIC	TUNGSTEN STEELS SHOULD NOT GENERALLY BE WATER COOLED
CRACKING	CARBURIZATION	CAUSES SURFACE CRACKING. USE PROPER ATMOSPHERE
	DECARBURIZATION	CAUSES MISLEADING HARDNESS. READINGS WITH INTERNAL HARDNESS TOO HIGH. USE PROPER ATMOSPHERE. CHECK INTERIOR HARDNESS AS WELL AS ON SURFACE.
	OVERHEATING	LOWER HARDENING TEMPERATURE OR USE SHORTER TIME. ANNEAL BEFORE REHARDENING. STEELS WITH FINE GRAIN CHARACTERISTICS WILL WITHSTAND OVERHEATING BETTER BUT PROPER HEAT TREATMENT WILL BRING OUT BEST QUALITIES IN ALL HOT WORK STEELS.
	STEEL NOT SUITABLE	5% CHROMIUM STEELS TOUGHER THAN TUNGSTEN BASE STEELS. USE FORMER WHERE APPLICABLE.
	HARDNESS TOO HIGH	TEMPER TO LOWER HARDNESS. CHECK HARDENING CONDITIONS.
	MECHANICAL	CHECK ALIGNMENT CLEARANCES, LOADING. AVOID SHARP CORNERS AND POINTS OF STRESS CONCENTRATION. IMPROPER SUPPORT. INSUFFICIENT CROSS SECTION AREA.
	EXCESSIVE INTERNAL STRESS	USE PROPER QUENCHING STRESS. RELIEVE AFTER GRINDING, REHARDENING, WELDING OR HARD FACING.
	EXCESSIVE TEMPERATURE GRADIENTS	HEAT AS UNIFORMLY AS POSSIBLE IN PREHEATING AND IN SERVICE. DO NOT ALLOW TO COOL UNDER 300 F. IN SERVICE.
WEAR-SCORING	DECARBURIZED	ENRICH ATMOSPHERE
	LOW HARDNESS	USE LOWER TEMPERING TEMPERATURE. CHECK HARDENING. CHECK FOR DECARBURIZATION.
	EXPOSURE TO EXCESSIVE HEAT IN SERVICE	USE STEELS WITH HIGHER RED HARDNESS. USE COOLANT. ALTERNATE USE OF TOOLS.
UPSETTING-BENDING	LOW HARDNESS	USE LOWER TEMPERING TEMPERATURE. CHECK HARDENING.
	CARBURIZED	CARBURIZED SURFACE RESULTS IN MISLEADING INTERNAL HARDNESS VALUES. USE PROPER ATMOSPHERE. CHECK INTERNAL HARDNESS.
	MECHANICAL FACTORS	CHECK ALIGNMENT LOADING, ETC.
	INSUFFICIENT STRENGTH	USE STEELS AND HEAT TREATMENT TO INSURE FULLY MARTENSITIC STRUCTURE ON QUENCH.

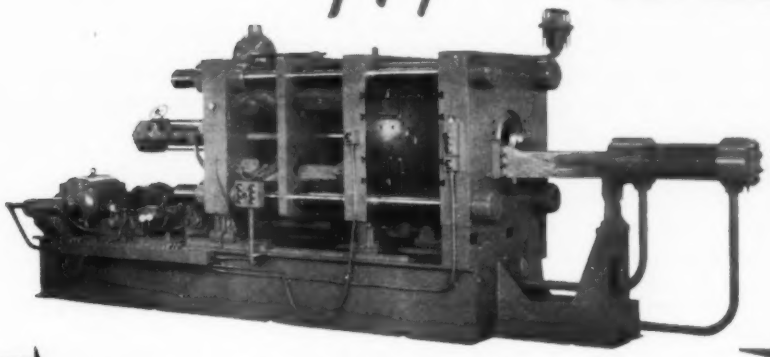
PROPERTIES OF EXTRUDED ALLOYS — TABLE XII

The Effect Of Extrusion On Low Carbon Steel

Extrusion %	Yield 0.1% Mpsi	Yield 0.2% Mpsi	T.S. Mpsi	El. in 2" %	RA %	Hardness R_B
			C 1010—Rimmed			
None	28.1	28.5	46.4	45	72	45
20	61.2	63.8	69.4	19	61	72
40	91.3	92.0	94.2	16	55	91
60	97.8	100.1	101.6	13	49	93
70	108.2	107.0	108.5	12	47	95
75	—	—	111.8	9	48	94
80	112.9	—	117.0	9	39	100.5
			C 1010—Killed			
None	35.2	36.0	52.5	44	73	58
20	59.9	64.0	68.1	19	64	80
40	80.8	85.3	91.2	16	55	88
60	92.2	96.4	101.0	16	50	95
70	96.6	101.1	107.2	14	49	94
75	95.8	102.4	110.7	15	49	95
			C 1019			
None	36.2	42.5	59.6	39	65	61
20	77.9	79.6	83.4	16	52	90
40	105.0	107.0	110.6	9	29	95
60	119.1	121.2	122.6	9	36	98
			C 1020			
None	32.8	40.2	58.0	38	62	57
20	75.4	77.3	79.8	13	48	79
40	98.9	101.2	104.8	9	36	92
60	112.6	114.4	115.2	9	35	95
70	119.6	122.4	123.2	11	41	100
			C 1040			
None	49.8	49.8	74.7	35	66	81
20	90.7	97.9	110.2	14	45	94
40	104.5	112.6	125.8	12	41	99
			A 4615			
None	46.1	46.4	71.0	34	65	72
20	79.0	82.4	91.5	14	41	92
40	92.2	100.1	110.7	8	22	98
60	114.2	120.2	128.2	10	31	101
			A 5120			
None	44.0	47.8	76.8	32	64	74
20	73.1	80.2	91.9	18	67	90
40	96.1	103.7	115.9	16	56	99
60	112.6	120.1	129.4	16	53	102

The STANDARD *Hydraulic* SYSTEM OF B & T

DIE-CASTING MACHINES



1. MEETS J. I. C. SPECIFICATIONS!

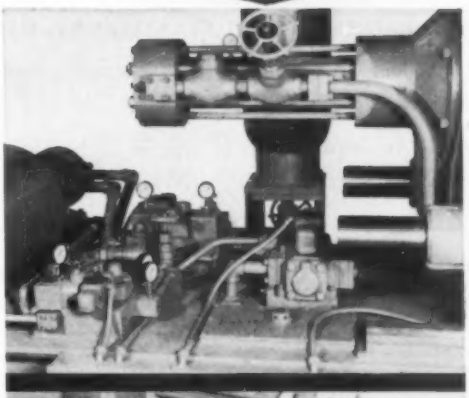
. . . a very important consideration in comparing both price and performance. For, this superior system of panel mounted hydraulics eliminates unsupported valves and threads between high pressure connections . . . permits very easy removal of valves for repair or replacement.

2. ELIMINATES LEAKAGE LOSSES!

Non-inflammable hydraulic oil is expensive and leakage losses are costly. With the B&T STANDARD system, loss of oil is negligible. Pipes have weldon fittings, socket welded to flanges which are bolted together with an "O" ring seal between mating surfaces to prevent leaks. Leaks cannot be caused by the normal hydraulic surges of a die casting machine because B&T uses heavy, rigid piping clamped firmly to the base at frequent intervals.

3. CUTS MAINTENANCE COSTS!

The B&T method of piping also saves time in disassembly, since it is only necessary to remove 4 bolts at each end of a pipe to free it from mating cylinders or parts.



The superior hydraulic system of B&T Die Casting machines is just one of several outstanding features that suggest the wisdom of thoroughly investigating B&T before buying any other. The line includes High-Pressure Cold-Chamber and Hot-Chamber Gooseneck types . . . in capacities of: 125, 150, 200, 300, 400, 500, 600, 700, 800 and 1,000 tons.

B&T GREENLEE DIE CASTING MACHINES

All of the engineering and manufacturing facilities of Greenlee Bros. & Co. are now available to B&T Machinery Co.

DIE CASTING RESEARCH

You are invited to use our Die Casting Research Center for experimentation and furtherance of die casting techniques.

B&T HYDRAULIC DIE CASTINGS TRIM PRESSES are exceedingly fast and efficient. Write for details.

B & T MACHINERY COMPANY

A DIVISION OF GREENLEE BROS. & CO., ROCKFORD, ILLINOIS

Holland, Michigan

For more information circle No. 10 on the Reader Service Card

Investment Casting Institute Standards

Part III: Airfoil Section Standards

ESTABLISHING standards for the airfoil field presents the same type of problems as have been discussed in the non-airfoil section. It is felt, therefore, that the system of standards by classes can be applied with minor exceptions in this area.

SURFACE FINISH

Since surface finish requirements for blades and vanes are generally more stringent (16-60 RMS) than those for non-airfoil parts, it is probable that customers will wish to depend on mechanical rather than visual measurement of surface finish. Since mechanical instruments presently available are not practical for 100% checking, the industry will still have to depend on a spot check to determine surface finish.

RADIOGRAPHIC STANDARDS — VANES

Scope: This standard sets forth radiographic standards for investment and ceramic shell cast vanes.

Definitions

1. An imperfection is defined as having moderate depth (up to 1/3 of the section thickness) when the X-ray film density in the surrounding area is 2.0-2.5 and the imperfection is dark grey but not black.
2. An imperfection shall be defined as "severe" (depth of more than 1/3 of section thickness) when the X-ray film density in the surrounding area is 2.0-2.5 and the imperfection, viewed by high intensity, appears black.

ACCEPTANCE STANDARDS

General

1. Cracks, cold shuts or crack-like indications are rejectable.
2. Acceptable limits for "moderate depth" imperfections. Limits for "severe" imperfections shall be reduced by one-half.
3. Gas holes and inclusions: Acceptable limits for vanes exceeding 1" chord are as follows:
   a. Maximum diameter = 1/8".
   b. Maximum number = 8 indications.
4. Gas holes and inclusions: Acceptable limits for vanes with chord width of 1" or less:
   a. Maximum diameter = 1/16".
   b. Maximum number = 4 indications.
5. Sponge shrinkage: Acceptable limits for vanes exceeding 1" chord are as follows:
   a. Maximum size = 1/4" at maximum dimension.
   b. Maximum number = 3 indications.
6. Sponge shrinkage: Acceptable limits for vanes with chord width of 1" or less:
   a. Maximum size = 1/4" at maximum dimension.
   b. Maximum number = 1 indication.
7. Maximum dimension for linear shrinkage:
   a. 1/2" maximum indication if perpendicular to chord line.
   b. 1/4" or 1/4 of chord width, whichever is less, if laying along chord line.
   c. Linear defects shall be separated from an edge or end of a vane by twice the minimum dimension of the defect.
8. Indication in fillet area greater than .025 at its maximum dimension is rejectable.
9. Defects other than linear shall be at least a distance equal to its largest dimension from any edge or end of a vane. In addition, defects shall be separated from each other by the smallest dimension of the smaller defect.
10. Imperfections which will be removed by machining shall not be cause for rejection.
11. Where visual imperfections create an X-ray indication, the imperfections shall be judged acceptable or rejectable based on pertinent visual standards.

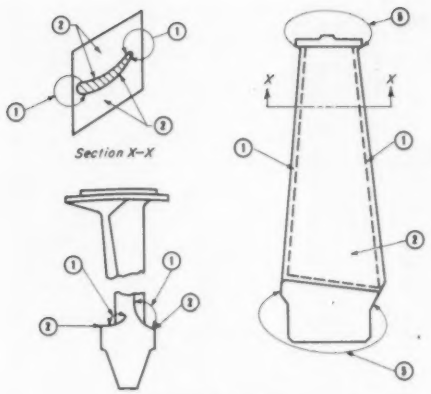
RADIOGRAPHIC STANDARDS — BLADES

Scope: This standard sets forth radiographic standards for investment and ceramic shell cast blades.

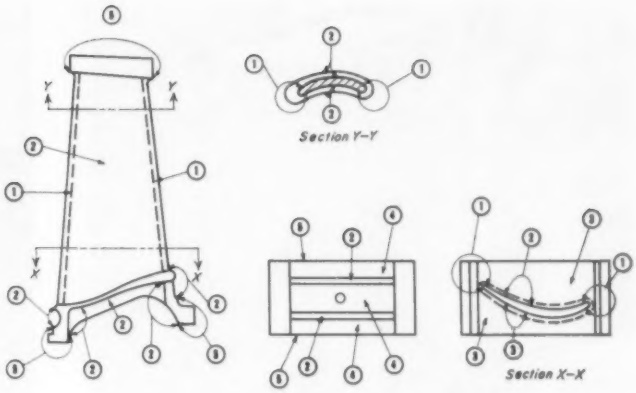
TABLE I: ACCEPTANCE REQUIREMENTS

Description of Imperfection	AREA 1	AREA 2	AREA 3	AREA 4	AREA 5
Cracks, Laps and Coldshuts	None Allowed	None Allowed	None Allowed	None Allowed	Any imperfection that will be removed by machining.
Pits, Nicks, Blowholes and Pinholes	None Allowed	1/32" Dia. x 1/64 deep and no less than 1/4" apart. Slight grind marks allowable.	1/32" Dia. x 1/64 deep and no less than 1/16" apart and less than 15 per square inch.	1/32" Dia. x 1/64 deep and less than 1/16" apart. No other limitations. Slight grind marks allowable.	Any imperfection that will be removed by machining.
Positive Metal Bubbles etc.	None Allowed	.010 Dia. x .010 high. Three per square inch.	.010 Dia. x .010 high. Six per square inch.	.032 Dia. x .010 high. Six per square inch.	No limitation.

It should be noted that imperfections can be removed from casting if smoothly blended and within allowable blueprint tolerances.



VISUAL STANDARD — BLADES



VISUAL STANDARD — VANES

Acceptance Requirements

1. Cracks, cold shuts or crack like indications shall be rejectable.
2. Shrinkage shall be acceptable only if the indication is so slight it is not clearly distinguishable from irrelevant indications such as "ghost lines."
3. Acceptable limits for gas holes and inclusions are as follows:
   a. Maximum dimension of any imperfection shall not exceed .040 or the section thickness at its location, whichever is less.
   b. Any defect must be located at least its maximum dimension from the trailing edge.
   c. Defects of .010 or greater shall be at least ½" apart. Smaller indication may be proportionately closer.
   d. Airfoil section shall not contain more than two indications of any type per inch of length.
4. Defects which will be removed by machining shall be acceptable, regardless of size.
5. Visual imperfections which create X-ray indication shall be judged acceptable or rejectable based on pertinent visual standards.

VISUAL STANDARDS

Scope: This standard is applicable to investment or ceramic shell cast blades and vanes.

Acceptance Requirements

Areas referred to appear on the accompanying sketches. Imperfection defined shall not be acceptable except as permitted for each class in Table I. Pits exceeding 1/64" in depth are considered non-bottomed.

TABLE II: FLUORESCENT PENETRANT STANDARDS — VANES

SCOPE: This standard sets forth fluorescent penetrant standards for investment and ceramic shell cast vanes.

Description of Imperfection	CLASS I	CLASS II	CLASS III	CLASS IV
Linear Indications of Shrinkage, Cold Shut, Oxide Skins, Cracks	None Allowed	None Allowed	None Allowed	None Allowed
Porosity or Micro-Shrinkage	None Allowed	Six 1/64" Dia. indications per fillet area and well dispersed.	1/32" Dia. Six per square inch. Clusters at least 1/4" apart.	Nine 1/32" Dia. imperfections per square inch. Clusters at least 1/4" apart.

Fluorescent penetrant indications may be removed if smoothly blended and part remains within dimensional tolerances. Any imperfections which may be removed by machining shall be acceptable. Indications which result from positive metal shall be acceptable if the positive metal is within the visual specification.

TABLE III: FLUORESCENT PENETRANT STANDARDS — BLADES

SCOPE: This standard sets forth fluorescent penetrant standards for investment and ceramic shell.

Description of Imperfection	CLASS I	CLASS II	CLASS III	CLASS IV
Linear Indications of Shrinkage, Cold Shuts, Oxide Skins, Pipes, Dross or Cracks	None Allowed	None Allowed	None Allowed	None Allowed
Porosity or Micro-Shrinkage	1/64" Dia. Three per square inch. No indication acceptable on leading and trailing edge radii.	1/64" Dia. Three per square inch. No indication acceptable on trailing edge radius.	1/32" Dia. Six per square inch. No indication acceptable on leading edge radius.	Any indications that will be removed by machining are acceptable.

Fluorescent penetrant indications may be removed if smoothly blended and part remains within dimensional tolerances. Indications which result from positive metal shall be acceptable if the positive metal is within the visual specification.

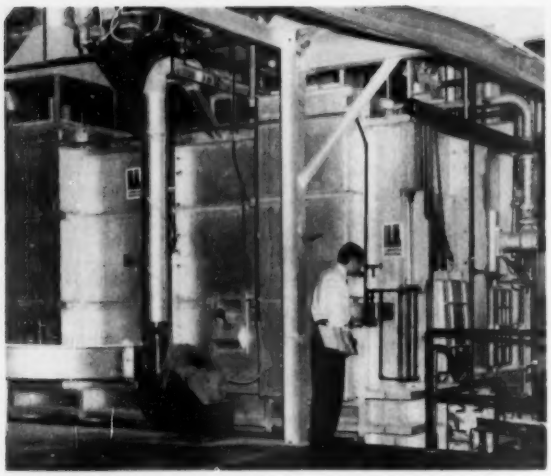


FIGURE 1. Aluminum holding furnace, 22,000 lb capacity.

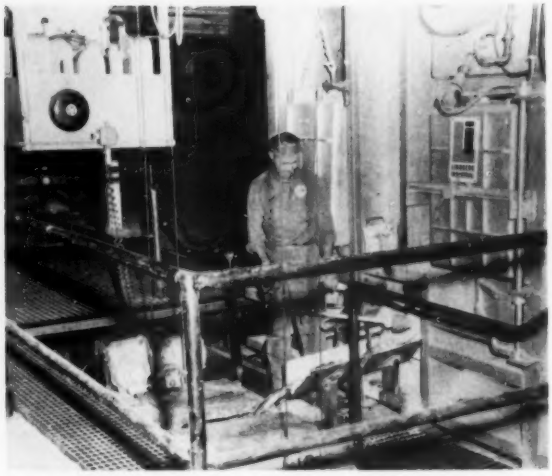


FIGURE 2. Tapping 22,000-lb-capacity holding furnace.

Chrysler avoids die casting rejects with modern . . .

Melting and Holding Furnaces

WHAT YOU DO to metal before it goes into the shot sleeve can determine the success or failure of your die casting operation. If you melt, flux, or hold your metal improperly, you will have a high reject rate from the casting machine.

Let's take a look at a good melting operation where every care is taken to insure that clean, properly-alloyed metal is delivered to the casting machines at the temperature best suited for the part being cast. This operation is in the aluminum die casting plant of the Chrysler Corp. in Kokomo, Ind. The plant is equipped with break-down and holding furnaces designed and built by Lindberg Engineering Co.

This plant has more than 40 die casting machines, with room for future expansion. Cast parts range in weight from a few ounces to 30 lb (shot weights). Production started in May, 1957, and since then, over 13 million castings have been produced, ranging from small engine parts to automatic transmission housings and torque converters.

BREAK-DOWN FURNACES

In an operation of this size, both quality and quantity of metal delivered consistently at the right time is important. Primary melting is done in two gas-fired reverberatory furnaces, each with a capacity of 30,000 lb of metal and a pour of 20,000 lb.

These furnaces have a melting rate of 6000 lb per hour, but actual present operation is about 3500 lb per hour. Maximum heat input from two burners is 12 million BTU per hour, with an average consumption of 9 million BTU per hour per furnace.

A molten heel of 10,000 lb is maintained in the break-down furnaces. A cold charge of 20,000 lb of metal goes into the furnace. The entire charge is brought up to 1400° F, salt fluxed, and then 20,000 lb is tapped off into a 22,000-lb-capacity foundry holding furnace.

MELT SHOP HOLDING FURNACES

Each break-down furnace is paired with a holding furnace in which final fluxing, degassing, and alloy adjustment is made. These furnaces are gas fired with a total heat input of 4 million BTU per hour per furnace and an average consumption of 800,000 BTU per hour. Molten metal is delivered at about 1400° F and levels off in the holding units at 1340° F.

While the preliminary, and heaviest, fluxing of the aluminum is done in the break-down furnace, a second salt fluxing must be done in the holding unit. The metal is chlorinated for about 25 minutes – also in this furnace – to remove finely-dispersed oxide, dirt, and dissolved hydrogen. Alloy adjustment and final laboratory analyses are made here.

CASTING MACHINE FURNACES

Each of the casting machine holding furnaces is fed from the 22,000 lb holding furnace by a 2000-lb-capacity cab-mounted monorail ladle. The casting machine furnaces are single-chamber design with a charging well at one end and the discharge at the other end.

A domed roof construction is used and heat is furnished by refractory type electric heating elements. Each furnace is rated at 30 KW. Temperature control on these small furnaces is at the discharge end and each one can be individually controlled to deliver metal at the best temperature for the particular casting being made.

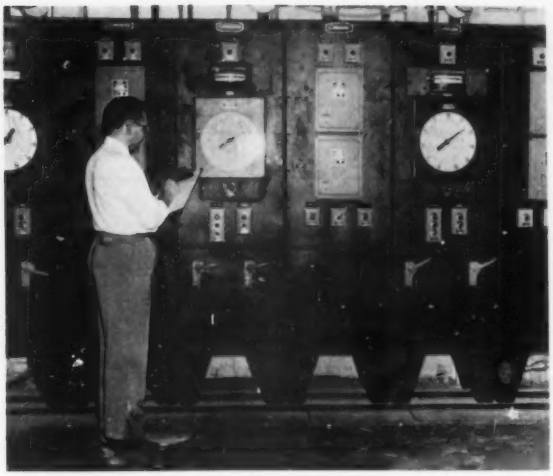


FIGURE 3. Controls: 30,000-lb melting, 22,000-lb holding.

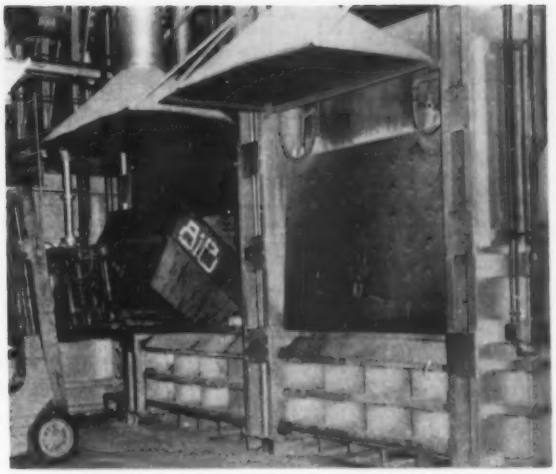


FIGURE 4. Charging 30,000-lb aluminum melting furnace.

AUTOMATIC LADLES

Twelve of the die casting machines are equipped with Lindberg Autoladle automatic metal ladling devices. With this equipment, the operator is relieved of hand ladling and each shot is precisely the same weight. In a 2000-lb-capacity furnace, a difference in metal level of about 4 in. represents a metal weight of 500 lb. These automatic ladling devices deliver constant shot weights within this metal variation, and no moving parts are immersed in the metal.

Aluminum is delivered to the die casting machine from near the center of the molten bath in the holding furnace. Thus, there is no chance of slag or oxide inclusions in the metal, and very little chance of getting appreciable amounts of dissolved gases.

The ladle mechanism is interlocked with the die casting machine so there is no chance of metal delivery until the machine is fully locked into casting position.

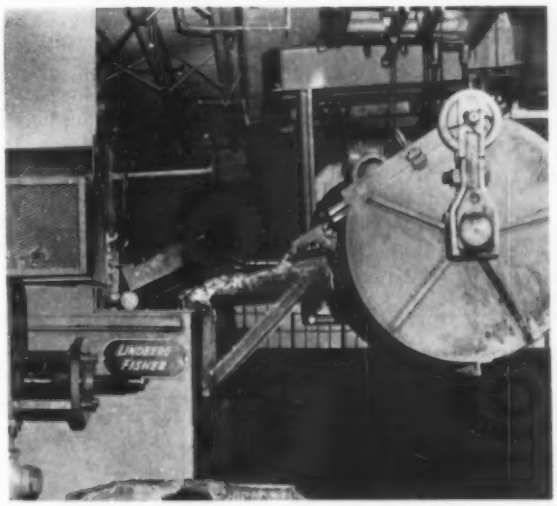


FIGURE 5. Charging SCE-2000 aluminum holding furnace.

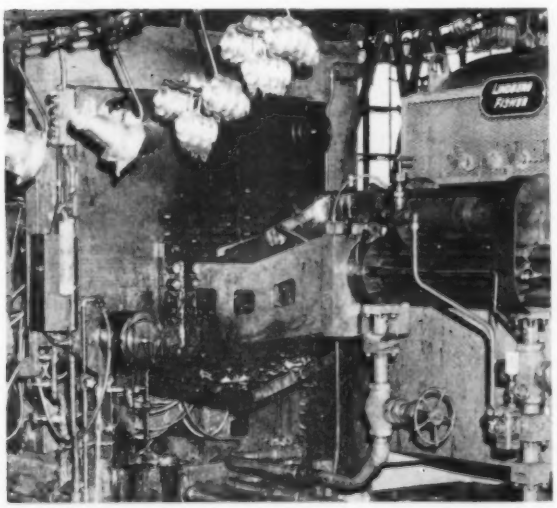


FIGURE 6. Type AL-30 Lindberg Autoladle installation.

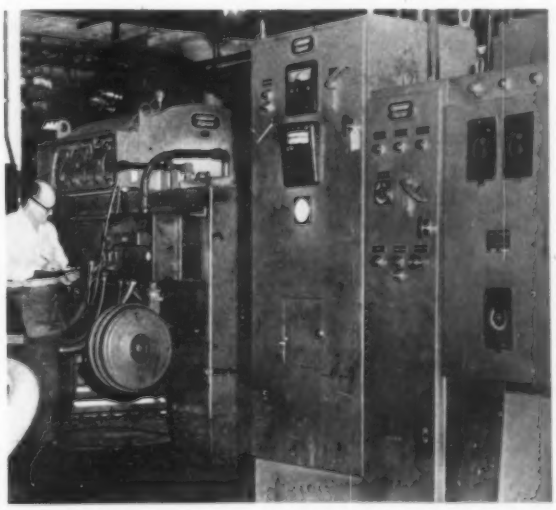


FIGURE 7. Controls: SCE-2000 furnace, AL-30 Autoladle.

PRODUCT STANDARDS FOR DIE CASTINGS

ADCI-E15-59T (Part 1)
FILLETS, RIBS, & CORNERS
(Fillets)

NOTE: The recommendations and notations herein represent normal production practice at the most economic level. Sharp inside surface junctions, acute angle corner conditions and delicate, deep and closely spaced ribs should be specified only where and when necessary since additional costs may be involved.

FILLETS, RIBS, AND CORNERS (Page One)

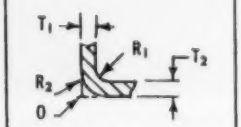
Fillets

Intersecting surfaces forming junctions of metal thickness are properly joined with fillets in order to avoid high stress concentrations in the die castings and to control and facilitate maintenance of otherwise squared edges in the casting die. Fillets projected in a direction normal to the parting plane require draft, but the amount is always governed by the draft of the intersecting surfaces. Draft in corners or fillets projecting in a direction normal to the parting plane have approximately 1.5 the amount of draft of the intersecting walls.

In the sketches below, consideration has been given to the stresses of use and to the stresses induced in the die castings by the process, as well as to die manufacturing and maintenance costs. The suggestions cover fillets on corners which are projected normal to the parting plane in die castings of moderate depth. Shallow die castings may have much smaller fillets, while deep pockets and other inside corners may have larger fillets. Sharply squared corners of much length projecting in a direction normal to the parting plane may cause spalled edges in withdrawing the die castings from the die.

RECOMMENDED

Where $T_1 = T_2$

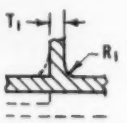


IF $R_2 = R_1 + T_1$; $R_1 = T_1$ WITHOUT LIMIT

IF $R_2 = 0$; $R_1 = T_1$ TO 1¼ T_1

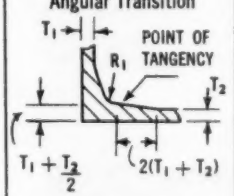
Where T_1 = Thickness of Thinnest Metal at Junction

Tee Junction



TEE JUNCTION
$R_1 = T_1$ TO 1¼ T_1

Angular Transition

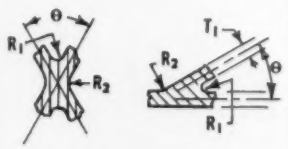


ANGULAR TRANSITION INCREASES STRENGTH BUT—COSTLY DIE WORK.

Where $T_2 > T_1$

$R_1 = \frac{2}{3}(T_1 + T_2)$
$R_2 = 0$ TO $R_1 + T_2$

Cross or "Y" Junction



$\theta = 90°$; ALL RADII EQUAL T_1
$\theta = 45°$; $R_1 = 0.7\ T_1$ $R_2 = 1.5\ T_1$
$\theta = 30°$; $R_1 = 0.5\ T_1$ $R_2 = 2.5\ T_1$

Deflector

DEPRESSION PROMOTES DENSITY, ESPECIALLY UNDER CYLINDRICAL BOSSES, BUT ADDS TO DIE COST.

LESS DESIRABLE

R_1 TOO LARGE

HEAVY MASS HERE NOT CONDUCIVE TO SOUND METAL

R_1 APPROACHING ZERO

DIFFICULT TO MAINTAIN IN DIE.

NOT RECOMMENDED

WEAK CASTING, DIFFICULT TO MAINTAIN IN DIE.

SHARP IRREGULAR EDGE—DIFFICULT TRIMMING.

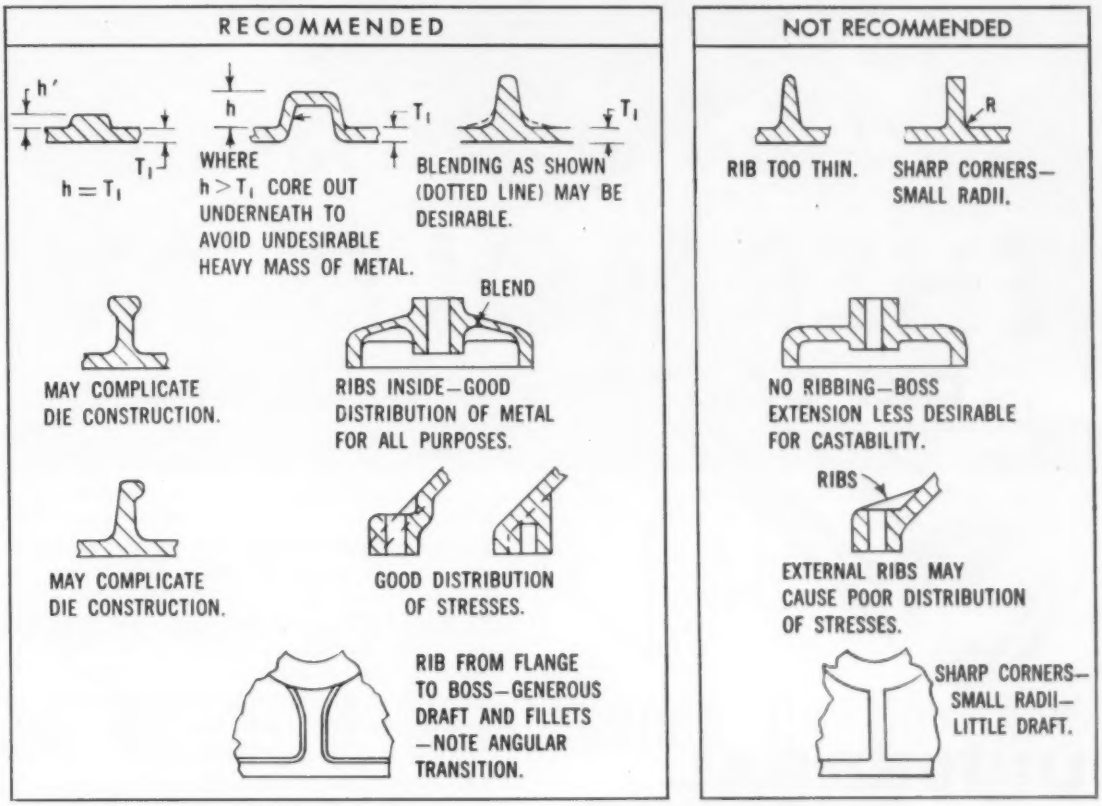
For Ribs and External Corners See Part 2

NOTE: The recommendations and notations herein represent normal production practice at the most economic level. Sharp inside surface junctions, acute angle corner conditions and delicate, deep and closely spaced ribs should be specified only where and when necessary since additional costs may be involved.

FILLETS, RIBS, AND CORNERS (Page Two)

Ribs

Ribs are used to increase the stiffness of, or add strength to, a die casting and to aid in making sound die castings. Ribs are sometimes *misused* and can be a detriment if working stresses are concentrated by their use or if stresses at the edges of the ribs are high.


RECOMMENDED
NOT RECOMMENDED
h'
h = T1
T1
h
WHERE h > T1 CORE OUT UNDERNEATH TO AVOID UNDESIRABLE HEAVY MASS OF METAL.
T1
T1
BLENDING AS SHOWN (DOTTED LINE) MAY BE DESIRABLE.
RIB TOO THIN.
R
SHARP CORNERS—SMALL RADII.
MAY COMPLICATE DIE CONSTRUCTION.
BLEND
RIBS INSIDE—GOOD DISTRIBUTION OF METAL FOR ALL PURPOSES.
NO RIBBING—BOSS EXTENSION LESS DESIRABLE FOR CASTABILITY.
RIBS
MAY COMPLICATE DIE CONSTRUCTION.
GOOD DISTRIBUTION OF STRESSES.
EXTERNAL RIBS MAY CAUSE POOR DISTRIBUTION OF STRESSES.
RIB FROM FLANGE TO BOSS—GENEROUS DRAFT AND FILLETS —NOTE ANGULAR TRANSITION.
SHARP CORNERS—SMALL RADII—LITTLE DRAFT.

External Corners

Sharply squared corners may be used in many locations if die construction permits. This type of corner is often mandatory at parting line locations and die block intersections. Other than this, corners of die castings should have radii in order to prevent early die failure, to reduce the probability of nicking the edge of the die casting in handling, and to minimize material handling hazards for personnel.

For Fillets See Part 1 of This Standard.

(NOTE: This standard and those to be published in two succeeding months are the latest to be issued by the American Die Casting Institute. These and all previous standards can be purchased from ADCI or ordered through PRECISION METAL MOLDING. To date, sixteen engineering standards have been issued. A complete listing will be in the September, 1959 issue of PMM.)

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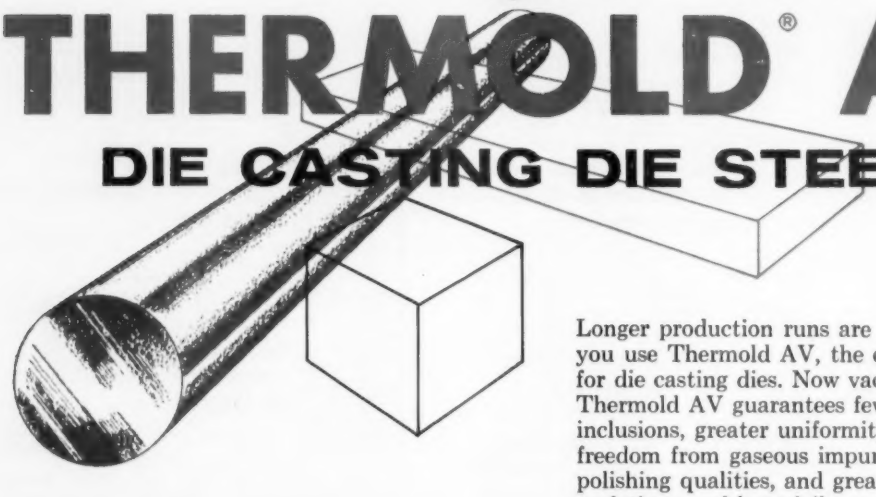

Longer production runs are assured when you use Thermold AV, the quality steel for die casting dies. Now vacuum degassed—Thermold AV guarantees fewer non-metallic inclusions, greater uniformity of structure, freedom from gaseous impurities, higher polishing qualities, and greater resistance to fatigue and heat failures.

When you specify Thermold AV, you specify the ultimate in melting techniques, plus quality controls which have set the standard for the industry—small batch furnace melting, close control of press forging and annealing, and 100% Reflectoscope testing.

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CROSS SECTION of the new extruded aluminum railroad boxcar inner-liner. Thicker bottom section, left, rests on the car floor. Thinner sections interlock for overall protection. Clip at right fastens panels to the walls (Inset).

Extruded shapes help railroads . . .

Cut WeigHt & Maintenance On Boxcars

AMERICAN RAILROADS faced with declining revenue and increasing costs are getting substantial help from the aluminum extrusion industry. By cuting the dead weight of boxcars the pay load per car can be increased. What's more, the useful life of the cars has been increased and maintenance costs materially reduced. How is it done?

Reynolds Metals Co. has developed a wall system which consists of extruded aluminum panels. They will blanket wall areas to any height desired above the floor. The extruded panels are interlocking so that the entire wall is protected against wear and tear in loading and unloading operations.

An extruded aluminum clip fastens the liners to the car wall with blind rivets, replacing the heavy, unwieldy welded-in method used with conventional steel liners. What's more, the need for periodic painting is eliminated and there is no danger of contamination of bulk products during shipment.

The liners are fabricated of 6063-T6 alloy. The bottom panels where the most bumping, scraping and wear occurs are ¼" thick, top sections ⅜" thick.

The weight of the panels is less than ⅓ that of comparable steel panels – this should effect a visible saving in day-to-day railroad operations. The aluminum panels become a permanent part of the car, but can be removed and re-used in the event of car retirement or damage.

The first installation of the new aluminum liners has been made in a Baltimore and Ohio Railroad car.

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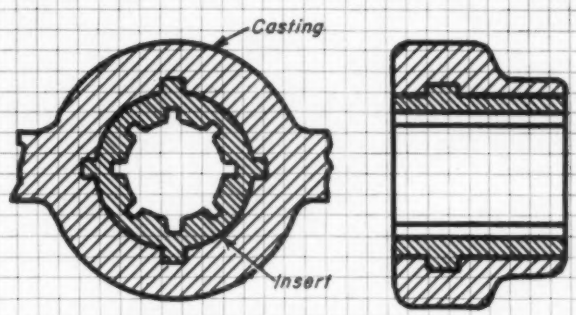
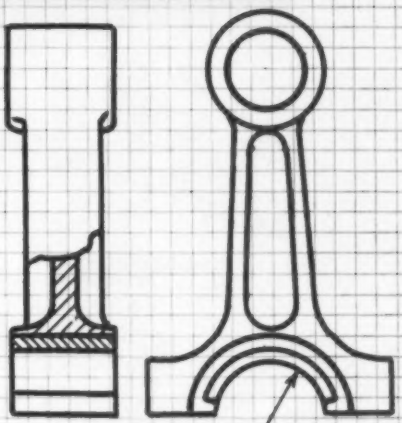
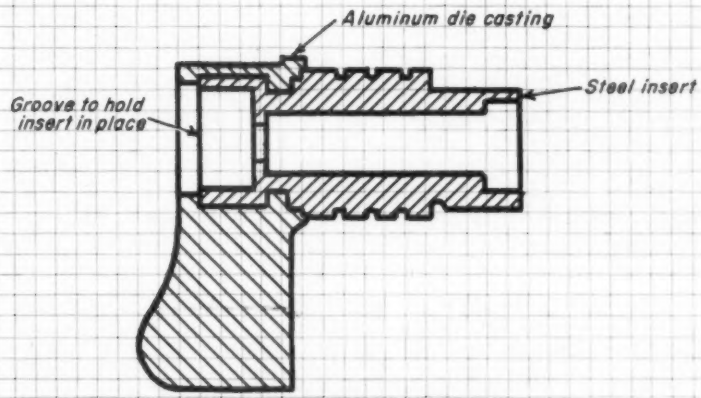
Properly designed inserts can broaden the application of die and permanent mold castings

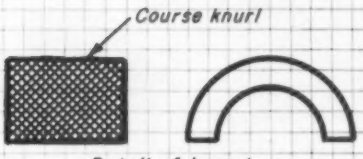


FOUR PROJECTIONS HOLD STEEL SPLINE IN CAST PIECE

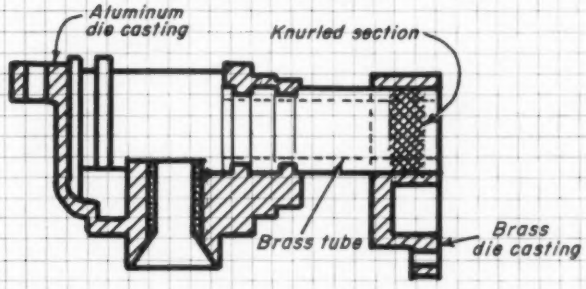




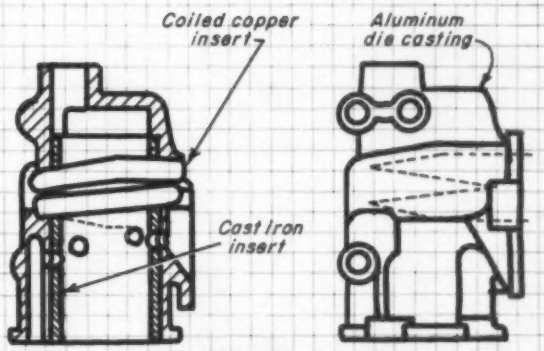
CAST-IN BUSHING SECURED BY GROOVE



BRONZE BEARING INSERT IN CAST CONNECTING ROD

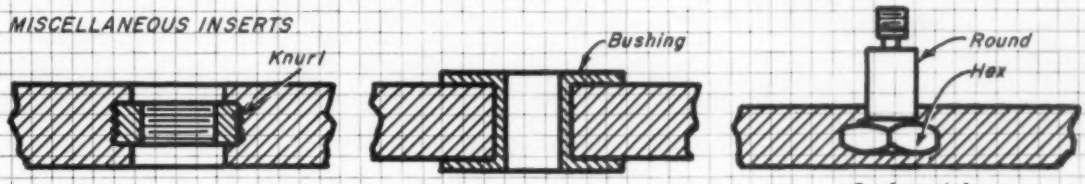


GROOVED AND KNURLED TUBE HOLDS TWO CASTINGS OF DIFFERENT METALS



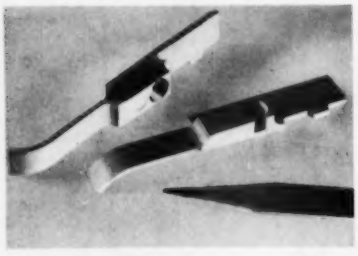
INTERNAL PASSAGES FOR COOLING OR FLUID DISTRIBUTION CAST IN USING COPPER TUBING

MISCELLANEOUS INSERTS

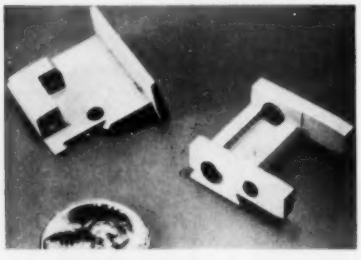


Reproduced by courtesy of McGraw-Hill Book Company, Inc.

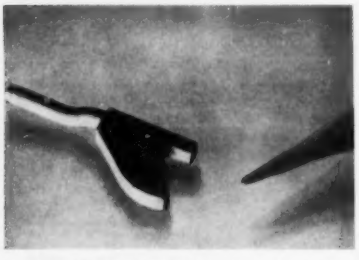
1 **EXTRACTOR** was a troublesome part; when cast, its performance improved.



2 **CARTRIDGE STOP** is long and thin, and has inherent strength throughout.



3 **REAR SIGHTS** are cast to very close tolerances; other methods were costly.



4 **CYLINDER STOPS** are used as-cast, eliminating scrap and tooling costs.

5 **THROAT PLATE CASTINGS** solved a production problem and worked better.

When firearms makers drew a bead on investment castings, they found that . . .

Cast Gun Parts Score Bullseye

ALERT firearms manufacturers who recently went hunting for better ways to make better guns came home with the investment casting process as prize game.

Here's why:

Hand and shoulder weapons take a lot of abuse and hard wear, are subjected to shock and weather conditions, and, above all, must be accurate and dependable. Also, hunters and target-shooters often consider appearance when selecting firearms.

Many parts made by the investment casting process meet these and other requirements. In fact, leading firearms manufacturers, such as Savage Arms, High Standard, and O. F. Mossberg, are now investment casting more than 40 different weapons parts, including bolts, triggers, barrel ring guides, ejectors, firing pin heads, front sights, sears, bolt operating handles, hammers, hammer catches, flip sights, etc.

Let's examine a few of these parts, noting some advantages gained by investment casting them:

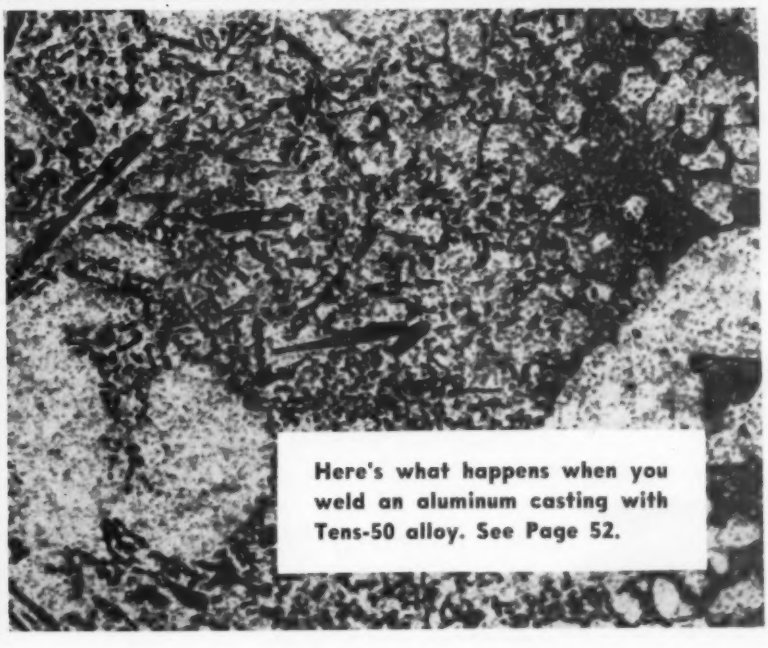
- **Extractor.** Producing a very small extractor for a .22-caliber rifle as a casting (Figure 1) improved its performance and eliminated manufacturing headaches. Because of stresses imposed by extracting shells at fairly high speed, it must be non-brittle. It is therefore made in 4140 alloy, with a carbon restoration process included.
- **Cartridge Stop.** A special alloy used for a long, thin cartridge stop for a 16-gauge shotgun (Figure 2) gives it a number of desirable properties, including non-brittleness. The part, which has to have a certain spring action and still bear up under impact, performs exceptionally well because of the casting's inherent strength in all directions.
- **Follower.** Cast in beryllium copper, a follower for a .22-caliber rifle is polished to a high sheen to give it the appearance of gold. The follower is visible when the bolt is opened, and it looks attractive. Also, it performs very well and has cut down machining operaations.
- **Ramp Sight.** Cutting serrations in a ramp sight was a difficult operation eliminated by investment casting. Fluidity of the beryllium copper used made it possible to have undercuts in the casting instead.
- **Rear Sights.** Rear sights for .22-caliber target pistols (Figure 3) are held to extremely close tolerances. Making these precise parts by other methods involves high tooling costs.
- **Frames.** Handgun frames are being investment cast with 50-80 micro-inch surface finishes. They blue very well and don't need much polishing.
- **Cylinder Stops.** Now used as-cast, cylinder stops for revolvers (Figure 4) formerly were stamped, hollow milled, bent, and drilled. The dual problem of high scrap rate and tooling cost is eliminated.
- **Throat Plates.** Throat plates for a .22-caliber rifle (Figure 5) were once a big production headache. Two plates had to be made by a multiple stamping die. Because of tolerance problems, assembling the unit took a great deal of hand fitting. Not only were the stamped plates unattractive, but they sometimes caused the rifle to jam. The investment cast throat plates look much better and don't cause jamming. The complexity of these plates is shown by the number of close dimensions: one throat has 75, the other 69.

Photos courtesy Casting Engineers Inc.

PMM

Finishing Section

The specialized finishing methods, equipment and materials used to machine, assemble, surface condition or surface coat precision metal molded parts are presented here. This includes all secondary operations which convert a raw casting to a finished product.



Here's what happens when you weld an aluminum casting with Tens-50 alloy. See Page 52.

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ON ALUMINUM

An IRIDITE-IRILAC finish will provide longer life for storm doors, windows, outdoor furniture, auto parts and accessories, tubing or wire goods. And, you have a choice of color finishes such as natural aluminum and golden yellow. Other colors may be obtained by an additional dye operation.

ON MAGNESIUM

IRILAC over an IRIDITE No. 15 finish increases corrosion protection, and provides resistance to finger printing and abrasion on all types of products, with color appearance ranging from light to dark brown.

ON ZINC

IRIDITE plus IRILAC gives your product longer life and brighter appearance. Color choices range from clear IRIDITE to olive drab, plus colored dye finishes.

IRIDITE is the tradename for a specialized line of chromate conversion coatings that can be applied to any non-ferrous metal by brush, dip or spray methods—at room temperatures—manually or with automatic equipment. Upon application, a thin film forms which becomes an integral part of the metal itself, and thus cannot chip, flake or peel. No special equipment, exhaust systems or specially trained personnel are required.

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For complete technical information on IRIDITE Chromate Conversion Coatings or IRILAC Clear Protective Coatings, write for FREE TECHNICAL MANUAL. Or, see the Allied Field Engineer in your area. He's listed under "Plating Supplies" in the yellow pages.

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Direct Chrome-to-Aluminum Plating

IN THE CHROM-LUME process of plating aluminum, a chromium deposit is bonded directly to the aluminum without any intervening metal, such as copper, nickel, or zincate.

This coating has demonstrated strong adhesion and high resistance to distortive bending and torsional and impact loads. It also has shown good abrasion resistance without chipping, flaking, peeling, or blistering of the plating. Since the Chrom-Lume process has no intermediate coating of other metals, there is no electrolytic action between dissimilar metals. And, little or no galvanic action disturbance can take place.

The secret of direct plating without any metallic or anodic oxide film lies in the pretreatment of the base metal. After the pretreatment, there appears to be complete penetration of the base metal surface. This special pretreatment process prevents oxidation of the cleaned surface by passivating the metal, and the following step reactivates the surface during the deposition of the bonding chromium coating. Desired thickness of plate and uniformity are controlled by instruments for temperature and timing.

The hardness of the chromium coating deposit averages above the normal Rockwell of plus 70 Rc, and the deposition is much denser than conventional hard chromium possessing a certain amount of ductility. Hammering the plated aluminum with a dull or sharp instrument causes flow of the deposit with the contour of the base metal without chipping or peeling. The deposit of chromium is probably intercrystalline with the aluminum, making the adherence so tight that plated parts may be struck, twisted, or bent without separating the plating (see illustration).

Another Chrom-Lume feature is its highly abrasive-resistant surface, which is estimated to be more than 100 times that of the base aluminum and 10 times that of hard nickel. Its low coefficient of friction gives longer wear life to components, plus improved surfaces free from any discolorations.

Panels plated on one side only with a .0005 thickness of Chrom-Lume were subjected to salt spray tests for 200 hours. Results showed approximately 6 points of corrosion or breakthrough of the plated surfaces. Another test showed that abrupt thermal changes may take place from —100° F to ambient temperatures and beyond 212° F without any physical or chemical changes of the plating or adherence of the bond.

Several case histories indicate the many possibilities for substituting light metals for heavy, expensive metals. One firm, manufacturing facsimile reproductions, used the Chrom-Lume process on aluminum castings. They showed longer wear life, despite a carbide stylus operating at 1500° F with 600 indentations a minute on the surfaced cylinder. Another firm replaced a costly, engraved, non-magnetic stainless cylinder with one of Chrom-Lume coated aluminum. Not only were costs reduced greatly, but the cylinder's wear life was tripled.

Here is a summary of the advantages offered by using Chrom-Lumed aluminum alloy components and products:

- Permits use of lighter metals with less machining and material costs.
- Economy of fabrication with greater wear and corrosion resistance.
- Intermetallic bond without copper, nickel, or zincate stops peeling and flaking action without discoloration transference to other materials.
- Allows greater compressive and tensile stresses, plus higher temperature range for durability of wear parts.
- No undesirable electrolytic or galvanic action occurs because there are no metallic undercoatings.
- Electronic controls permit uniformity of depositions to closer tolerances than conventional methods of deposition.
- Chromium deposition being direct and dense allows greater coefficient of expansion because of the ductility of the plating.
- Lubrication requirements are lessened or eliminated because of the low coefficient of friction.

NOTE: This report was prepared by the Service Research and Development Division of Service Hard Chromium Co., Union, N. J.

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High Strength Welds In Aluminum

FOR MANY YEARS 4043 alloy has been used as filler metal in joining and repairing wrought and cast aluminum alloys. This 5% silicon alloy has good fluidity, good ductility, and does not exhibit hot shortness. It has the drawback that it does not respond to heat treatment. Heat treatable alloys, therefore, must accept a reduction in potential strength properties when welded with this material.

An investigation was made to test the welding properties of Tens-50 alloy. It was expected that welds made with it would respond to heat treatment and permit use of welded parts at full strength values.

METALLURGICAL FACTORS

Tens-50 is an alloy of aluminum, silicon and magnesium. Sodium modification of the silicon eutectic and the addition of beryllium to modify iron needles into dispersed spheroids permit the use of silicon and magnesium in larger amounts and thus improve fluidity and heat treatment response. Like all heat treatable aluminum alloys, Tens-50 is age hardening. The hardening agent is magnesium-silicide.

A major factor in determining the ductility of a cast aluminum alloy is the micrograin size. This is controlled almost entirely by the chilling rate, and in a weld this is extremely rapid. Tens-50 has excellent fluidity due to its high silicon content and its good ductility when permanent mold cast should make it an excellent filler material.

FILLER ROD PRODUCTION

Tens-50 alloy can be extruded. Experimental quantities of ⅜" diameter rod were extruded from 1" diameter billets. At 1000°F approximately 30 tons was required to produce the rod at the 64:1 extrusion ratio used. The surface was good and the rod uniform in diameter. Production quantities could be produced easily.

WELDING CASTINGS

Cast 356 tensile test bars were notched ¾ through the reduced section, then welded using 4043 rod and Tens-50 rod. The welds were filed to eliminate buildup and the bars heat treated to 356-T6. The pulled bars are shown in Figure 1. The bar welded with 4043 broke in the weld and the bar welded with Tens-50 broke outside the weld in the parent metal. Both welds were clean and free of cracks and porosity.

In another test, a Tens-50 pump volute was prepared by drilling a tapered hole through a ½" section. The hole was ¼" diameter at the bottom and about ⅜" diameter at the top. Through another ½" thick section a pie-shaped wedge was cut. Both holes were repair welded using Tens-50 rod, then sectioned for examination. Figure 2 shows the structure of the weld and the weld affected zone in the parent metal. The fine grain size expected from this alloy is apparent in the weld metal. With a weld of this nature, there would be no loss of strength in the heat treated condition.

JOINING 6061 ALLOY

This is a commonly used alloy where wrought or extruded material is employed in the heat treated condition. It contains 0.6% silicon and 1.0% magnesium. It tends to be hot short. To weld it, a filler rod with good hot ductility must be used. When thin sections, up to 1/16" thick, are welded with 4043 rod there is some diffusion of magnesium into the weld metal and the strength, after heat treatment, is better than the basic strength of 4043. In heavier sections, the chilling action is so rapid that diffusion can not take place. The weld then has the strength of 4043 alloy.

By using Tens-50 filler rod, the weld metal is heat treatable regardless of the size of the weld.

In tests, two ¼" thick plates were welded, using a 45° chamfer on

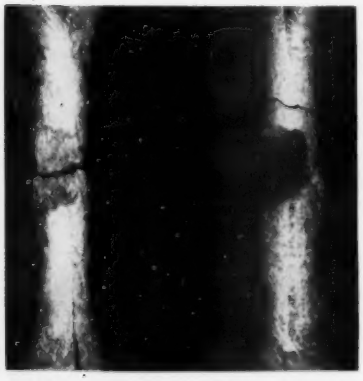

FIGURE 1. Test bar welded with 4043 broke in weld (left); bar welded with Tens-50 broke outside the weld.

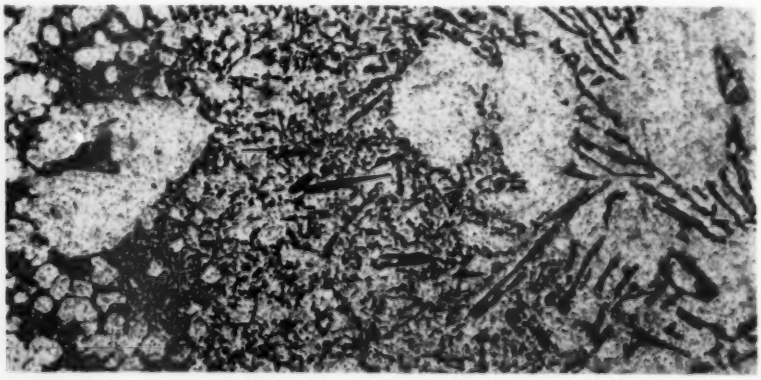

FIGURE 2. Here's a photomicrograph (200X, reduced about one-half here) of fusion repair weld in Tens-50. Casting is shown at the extreme right, middle zone is casting affected by weld, grain of weld metal is at left.

each piece. Welds were made in two passes using 4043 rod and Tens-50 rod. The plates were heat treated to 6061-T6 and tensile bars machined, removing all weld reinforcement. The results of these tests are shown in Table I.

Figures 3 and 4 illustrate these test bars.

Duplicate welds were made and test bars machined as before. In this case the weld areas were undercut as shown in figure 5 to insure failure in the weld and thus determine the strength of the weld metal. Table II gives the results.

The 4043 broke with strengths some 2/3 of the 45,000 psi expected of 6061-T6. The Tens-50 welds gave strengths 5,000 to 6000 psi higher than the base metal. In all cases the test bars were heat treated for the best properties in the base metal, not in the filler rod.

OTHER METAL COMBINATIONS

Various combinations of alloys 6061, 4043 (filler rod only), Tens-50 (base metal and filler rod), and 6066 were tested. In all cases either 4043 or Tens-50 filler rod was used. These tests included both room temperature and —320°F tensile tests. In all cases the welds were machined down to give true weld metal strengths. In all cases where 4043 filler rod was used the strength of the assembly was that of the filler metal. When Tens-50 rod was used the assembly showed the expected strength of the parent metal and fracture always occured in the base metal unless a flaw was present in the weld.

In the tests at liquid nitrogen temperatures (—320°F) the 6061 alloy increased in strength faster than the Tens-50 so that the strength of the weld metal predominated at a little over 60,000 psi.

The results of the test work done indicates that Tens-50 filler rod can be used for the repair and joining of both cast and wrought aluminum products. Subsequent heat treatment will develop a stronger structure in the weld than in the parent metal so that the full potentialities of the base alloy can be realized in design.

The Tens-50 alloy is easily extruded into filler rod on a production basis.

The above material is from Report No. NAV 20-1-15 and Supplemental Report No. NAV 20-1-15 both issued by Navan Products, Inc. Complete copies of the reports are available from the company.

TABLE I

MATERIAL		HEAT TREATMENT		ULTIMATE TENSILE, PSI	REMARKS
Parent Metal	Weld Rod	Solution	Age		
6061	4043	8 hrs.@ 975°F	8 hrs.@ 350°F	32200 32200 32300 32100	All bars broke in the weld
6061	Tens-50	8 hrs.@ 975°F	8 hrs.@ 350°F	45440 45900 45400 45500	All bars broke outside the weld

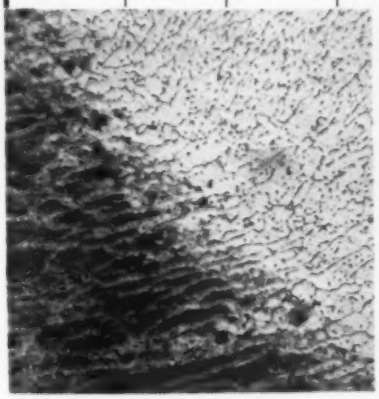

FIGURE 3. This is cross-section of weld (200X, ½ reduction) in 6061 with Tens-50 rod, heat-treated to 6061-T6.

FIGURE 4. Weld at left, with 4043, broke at 32,200 psi; bar with Tens-50 weld broke in the 6061 at 45,500 psi.

TABLE II

MATERIAL		HEAT TREATMENT		WELD DEPOSIT ULTIMATE T.S. PSI	REMARKS
Parent Metal	Weld Rod	Solution	Age		
6061	4043	8 hrs.@ 975°F	6 hrs.@ 350°F	32800 31500 30100 19400 32300	 Flaw
6061	Tens-50	8 hrs.@ 975°F	6 hrs.@ 350°F	50800 49200 50800 51700 51700	 Flaw

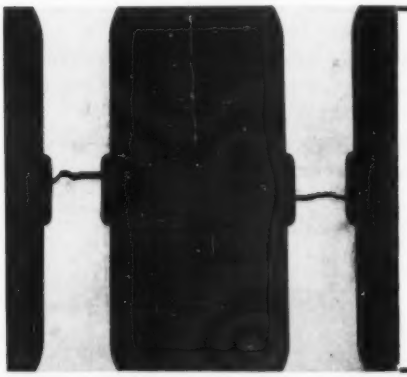

FIGURE 5. These samples were machined in the weld area, with the weld itself undercut to insure failure there. The bar at the left, welded with 4043 rod, broke at 31,700 psi. The other bar, welded with Tens-50, broke at 50,800 psi. Test bars were heat treated for best properties in the base metal, not in the filler rod. In other Tens-50 tests, the base metal fractured.

USEFUL LITERATURE, CATALOGS, MANUALS

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PROCESSES

163 **Investment Casting** — HITCHINER MFG. CO. — Research report on the use of refractory shells as an aid to investment casters.

164 **Sinterings** — GENERAL SINTERING CORP. — Technical report on the process and the standard metals and alloys used.

165 **Sintered Steel** — BURGESS-NORTON MFG. CO. — Technical paper on low cost, high strength sintered steel parts.

166 **Investment Castings** — NATIONAL PRECISION CASTING CORP. — Tabular data on the typical engineering properties of beryllium copper casting alloys.

167 **Sinterings** — JOHNSON BRONZE CO. — Tabular data on ferrous and non-ferrous alloys for powdered metal bearings and mechanical components.

168 **Plaster Mold Castings** — UNIVERSAL CASTINGS CORP. — Engineering report on the selection of materials, processes and design considerations for vacuum cast plaster mold castings.

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172 **Engineering Handbook** — THE BUNTING BRASS & BRONZE CO. — 23-page engineering handbook on powder metallurgy. Includes data on all phases of the process from design to machining the part.

173 **Precision Castings** — UNIVERSAL CASTINGS CORP. — Technical data on brass and bronze vacuum cast precision castings.

174 **Sinterings** — THE BUNTING BRASS & BRONZE CO. — Technical data on sintered powdered bronze stock bearings and bars.

MATERIALS & EQUIPMENT

175 **Induction Heating** — PITTSBURGH INDUCTION HEATING CO., INC. — Literature on induction heating equipment for billets and extruding.

176 **Shoulder Bushings** — DETROIT MOLD ENGINEERING CO. — Vol. 17 No. 4, of the D-M-E News contains data on standard shoulder bushings, leader pins.

177 **Hot Work Steel** — COLUMBIA TOOL STEEL CO. — Technical data sheets on the composition and advantages of various hot work steels for aluminum, magnesium die casting dies, hot extrusion dies, etc.

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179 **High Strength Alloys** — COPPER ALLOY CORP. — 10-page technical report on PH55 Alloys. Contains data on composition ranges, mechanical properties, etc., of the superior molybdenum containing 18-8 type PH55 stainless alloys.

180 **Equipment Handbook** — PRECISION EQUIPMENT CO. — A free subscription to the company's Equipment Manuals which describe and illustrate new products for both plant and office.

181 **Stainless Tubing** — THE BABCOCK & WILCOX CO. — Technical Data Card 192 describes the high temperature properties of Croloy 25-12 (309).

182 **Nondestructive Testing** — MAGNAFLUX CORP. — Technical literature on a transistorized unit that uses eddy currents to measure and sort nonmagnetic metals

183 **Magnetic Amplifier** — MINNEAPOLIS-HONEYWELL REGULATOR CO. — Technical data on the Brown Magnetic Amplifier for current-proportioning control instruments.

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186 **Iron Powders** — NATIONAL-U.S. RADIATOR CORP. — 11-page technical report on the production of iron powder and the utilization of metal powders.

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190 **Sintering Furnace** — SURFACE COMBUSTION CORP. — Engineering report on a pusher type gas fired sintering furnace.

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continued on page 56

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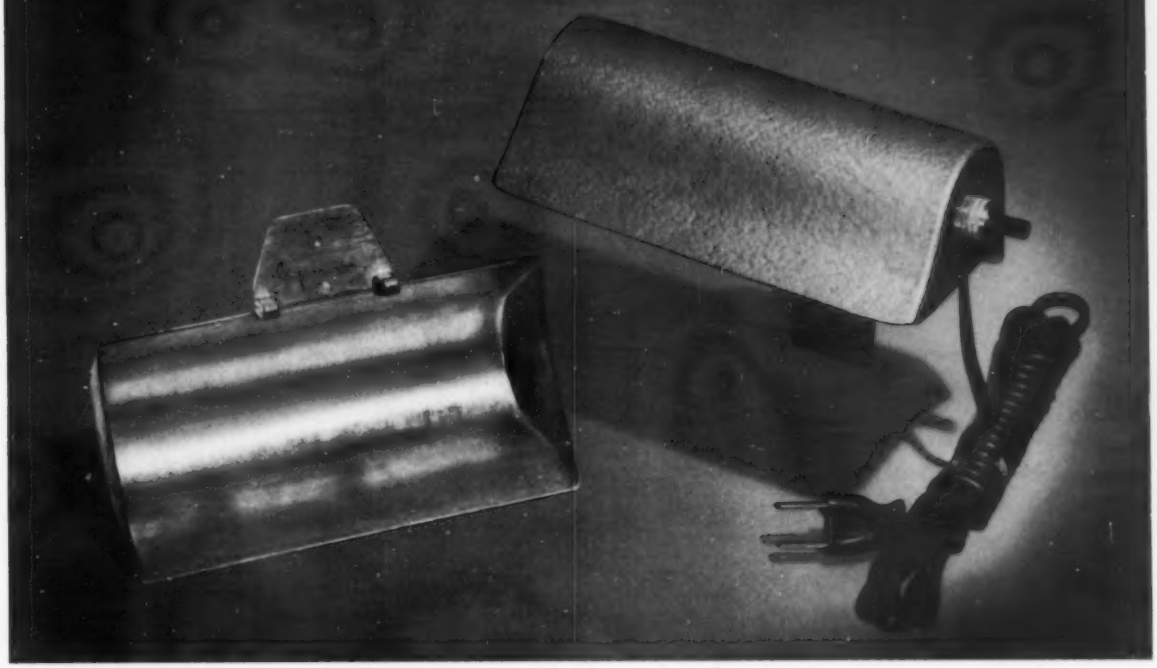

AND EASY TO ASSEMBLE WHEN DIE CAST WITH... ZAMAK

The shade for this new KLIP-LITE* music stand is made of a single thin-wall zinc die casting—for light weight and low-cost assembly. As thin as a stamping but with far greater rigidity, the contours could not be duplicated in sheet metal.

By designing for die casting, only 4 holes are needed before spray finishing and assembling the socket-switch and mounting bracket.

These extremely thin wall sections—possible only with ZINC die castings—minimize weight and are stronger in proportion to thickness than heavier sections.

Parts designed for ZAMAK alloy die casting will meet competition of either stampings or aluminum castings—and at lower cost.

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160 Front Street • New York 38, N. Y.

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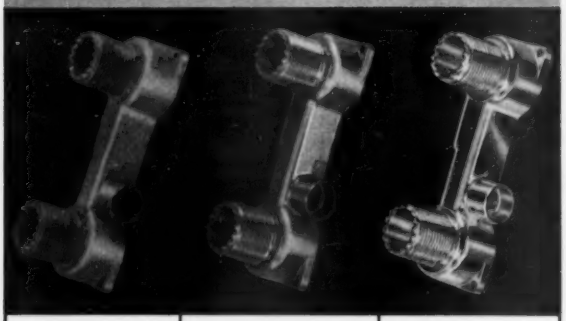
Duracoat®

for Die Castings



UNTREATED	PROTECTED	CHEMICALLY POLISHED
DULL	GOLDEN COLOR	BRIGHT

For chemically polishing, deburring and protecting zinc and aluminum die castings

DURACOAT® DCP-3 and -5. Zinc die cast parts can now be chemically polished by simple immersion. Costly hand or mechanical operations can be eliminated or supplemented with these solutions. Use for reclaiming stripped parts; prior to plating for brighter deposits and increased throwing power into low current density areas, and as a final finish.

CHEMBURR® 3 and 5. For chemically deburring zinc die castings. Eliminates costly mechanical tumbling and hand deburring operations. Internal holes and threaded sections completely deburred and chips removed by simple immersion.

DURACOAT® C. Liquid chromate product for producing bright, irridescent or golden protective finish on zinc die casting. Fast, simple, economical to use. Highest quality at lowest cost.

ALCHROME® #1 and #2. Clear or yellow golden chromate finish for aluminum. Outstanding protection. Can be used to replace anodizing where hardness is not a requirement.

All **DURACOAT®** products meet existing military specifications.

Write for free technical data sheets describing products in detail. Send samples for free processing.

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or 701 North Sangamon Street, Chicago 22, Illinois

36 Years of Service to the Heat Treating and Metal Finishing Industry

For more information circle No. 50 on the Reader Service Card

USEFUL LITERATURE

continued from page 54

194 **Iron Powders** — REPUBLIC STEEL CORP. — Data sheet on the tensile strength of the company's iron and alloy powders.

195 **Stainless Steel** — THE INTERNATIONAL NICKEL CO. — 40-page technical report on stainless steel in product design.

196 **Intermetallics** — METALS CO., DIV. OF U.C.C. — A series of technical data sheets on intermetallics that are available in powder form: Chromium boride; chrominum carbide; molybdenum disilicide; etc.

204 **Cutting Fluid** — E. F. HOUGHTON & CO. — Engineering report on modern cutting fluids.

205 **Special Metals** — JOHNSON & FUNK METALLURGICAL CORP. — 8-page engineering report on shapes available in titanium, zirconium, tantalum, and other metals.

206 **Cemented Carbide** — SINTERCAST CORP. OF AMERICA — Technical data sheet on a new machinable cemented carbide.

207 **Materials Technology** — CARBORUNDUM CO. — 12-page research report on Magnesium Oxide and other refractory materials.

208 **Aluminum Alloys** — REYNOLDS METAL CO. — 17-pages of tabular data on hundreds of alloys and forms of aluminum available.

209 **Sintering Press** — WATSON-STILLMAN PRESS DIV. — Data sheets on a press for producing powder metal parts of complicated cross section.

FINISHING

197 **Rhodium Electroplating** — SEL-REX CORP. — 20-page technical booklet on the rhodium electroplating process.

198 **Metal Mender** — SCHMIDGALL LABORATORIES' — Technical data on "Met-L-Urge", a metal mending compound in special mixtures for iron, aluminum, bronze and copper.

199 **Simulates Plated Finishes** — MAAS & WALDENSTEIN CO., INC. — Engineering data on a finish that simulates brass, gold, copper, etc., while providing a protective chemical coating.

200 **Cleaner** — OAKITE PRODUCTS, INC. — Technical literature on Compound No. 86, a versatile cleaner that cleans, removes smut, protects steel, and cleans aluminum, brass and zinc.

201 **Tumbling Barrels** — TUMB-L-MATIC, INC. — Technical data file on tumbling barrels and compounds.

202 **Steel Electrocleaner** — ENTHONE, INC. — Technical literature on Enbond Cleaner FE-84, a heavy duty, high conductivity, anodic cleaner for steel.

203 **Mechanical Finishing** — ROTO-FINISH CO. — 30-page technical report on precision mechanical finishing and automatic finishing processes.

210 **Self-Threading Nuts** — THE PALNUT CO. — 8-pages of data on self-threading nuts which form threads while tightening on zinc and aluminum die cast studs.

211 Diamond Wheels — THE CARBORUNDUM CO. — Technical data on diamond wheels (natural and man-made) for carbide grinding.

212 Finishing Chemicals — ALLIED RESEARCH PRODUCTS, INC. — Technical data file on process chemicals for metal finishing.

213 Machining Aluminum — REYNOLDS METALS CO. — 32-page engineering reference handbook on all aspects of machining aluminum.

214 Cleaning Industrial Floors — OAKITE PRODUCTS INC. — Booklet tells how to efficiently and economically clean and care for industrial floors.

215 Self-Tapping Studs — PHEOLL MFG. CO. — Technical data on self-tapping, self-locking studs that save time, materials.

216 Groove-Pins — GROOV-PIN CORP. — Technical data on Groov-Pin press fit fasteners that require no tapping or reaming.

217 Trim Presses — HANNIFIN CO. — Technical literature on the "FD" series high-speed, bench-type hydraulic production presses for trimming small die castings, etc.

218 Metal Processing Service — PENNSALT CHEMICALS CORP. — Literature on a complete metal processing service that ranges from the design, installation and service of a variety of machines, to the selection of the compounds and chemicals.

219 Automatic Tracing Attachment — TRUE-TRACE SALES CORP. — 6-page technical bulletin on Synchro-Trace, a fully automatic tracing attachment for milling applications.

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GENERATORS — 1 KW; 2½ KW; 5 KW; 10 KW; 20 KW; 30 KW; 50 KW; 75 KW; 100 KW.
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pressed (40 tsi) & sintered 7.0 gms/cc

UTILIZING SHORTER TOOLS

• *lower costs* • *less breakage* • *higher loading for high density* • *less spring back*

INCREASING PART SIZE & WEIGHT

• *higher compressibility plus lower compression ratio means increased height area weight per part*

Merisinter Standard Grade A.D. 3.3 gms/cc
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Strength, low cost, and accuracy let . . .

Sinterings Replace Stampings

REDESIGN takes vision as well as design know-how. Visualization of a part made by an entirely different manufacturing method often leads to a better part at a lower cost. It did for Lehigh, Inc. when Amplex Div. engineers looked at an assembly of three stampings, one screw machine part and two rivets which made up a portion of the coin acceptor on a vending machine.

Both strength and accuracy were needed in the piece and its shape was a natural for powder metellurgy. As redesigned, the part functions as well or better than the piece it replaces and a number of secondary operations including milling, drilling, tapping and assembly have been eliminated. Now only a tapping operation needs to be done. Naturally, the cost was greatly reduced.

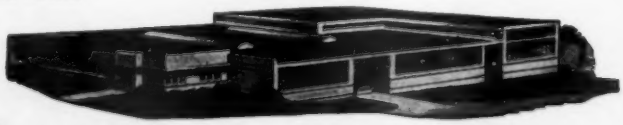
You can benefit by Milwaukee's 50 Years' Service to Industry

50th ANNIVERSARY
1909-1959

Since 1909, it has been the privilege of the Milwaukee Die Casting Company to work with manufacturers of a wide variety of products . . . from mechanical pencils to airplanes . . . in applying the die casting process to their problems of parts design and production. In those 50 years, Milwaukee has pioneered many of the developments which have since become standard practice.

If you wish to benefit by our 50 years of continuous service to industry coupled with the advantages of our modern die casting plant, we invite your inquiries.

Milwaukee operates under the Certified Zinc Plan of the American Die Casting Institute.



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Increase production hundreds to one over hand methods. Reduce labor costs. Eliminate need of experienced workmen.

CLAMPS AND FIXTURES
Positive pressure and exact registration of the part in the mask. Reduce rejects. Free both hands for productive movements.

SPRAY PAINTING MASKS
A competent engineering staff will counsel with you on the most efficient technique for handling your particular requirements.

MASK WASHING MACHINES
50% faster than any other make. Cut solvent consumption. Avert production delays due to damaging of masks by hand scrubbing.

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LINDBERG DEVELOPS NEW MELTING LINE

LINDBERG ENGINEERING CO. has developed a new type of metal melting line which is designed to continuously melt and deliver a constant, uniform flow of oxide-free copper at a constant temperature.

Lindberg says that, because of the construction of the equipment, metal is of high conductivity grade and almost chemically pure, as no alloying materials come in contact with the metal. The refractory which contains the molten material is entirely inert.

REDMOND JOINS FIRTH-STERLING

John C. Redmond, former vice president in charge of metallurgical research and development for Kennametal, Inc., has joined FIRTH-STERLING, INC., as director of research. A top authority on powder metallurgy, Redmond will concentrate on work on tungsten, titanium, and chromium carbides.

PABCAST EXPANDS

PABCAST CORP., Gardena, Calif., is adding a 10,000-square-foot steel building to its aluminum and brass casting plant. The firm recently upgraded its quality control and inspection to meet the high precision tolerances required by the military and high-accuracy commercial products.

MERCAST NAMES HULEGUARD

At a recent annual meeting, MERCAST CORP. re-elected seven incumbent directors and elected Harold V. Huleguard to fill a vacancy on the board. Huleguard is president of Gray & Huleguard Inc., a Mercast subsidiary. Norris N. Heinbuch, Mercast secretary-treasurer, was elected vice president of the firm.

ALCOA PROMOTES SHARP

William H. Sharp has been appointed works chief engineer at ALUMINUM CO. OF AMERICA's Vernon, Calif., works. He formerly was with the Alcoa Research Laboratories and at Lafayette, Ind., and Pittsburgh, Pa.

ADEPT CASTINGS MOVES

ADEPT CASTINGS, INC., has moved from Freeport, N. Y. to 5 Henrietta St., Hicksville, N. Y.

SINTER BRASS COMPACTS IN NITROGEN

with lithium stearate

Recent research indicates improved physicals for brass compacts using lithium stearate as a lubricant and nitrogen as the sintering atmosphere.

Typical results promise 20% stronger, 100% more ductile parts as well as safer, more economical sintering operations.

TRY IT NOW YOURSELF!

All you need is a special powder metallurgy grade lithium stearate (fluffy) available only from us. We'll send you complete facts and lubricant samples on letterhead request. Foote Mineral Company, 474 18 West Chelten Bldg., Phila. 44, Pa.

FOOTE MINERAL COMPANY

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NEWS OF INDUSTRY & ASSOCIATIONS

activities of people, companies & groups in the precision metal molding industries

U. S. TRADE MISSION members who studied India's market potentials. Top row (left to right) Ralph M. Binney, Paul H. Brent, Harvey F. Swenson. Bottom row (left to right) Ray William Cline, David B. Hanna, Herbert C. Murrer, William M. Shepherd.

INDIA: NEW MARKET FOR PMM MACHINERY?

A new market for all types of machinery was explored by a seven-member U. S. Trade Mission which recently toured 14 major cities in Eastern India. Organized and sponsored by the DEPT. OF COMMERCE, the Mission explored ways to develop a larger two-way trade between India and the United States. It held group meetings with some 3000 businessmen, and developed more than 200 tangible opportunities for trade or investment.

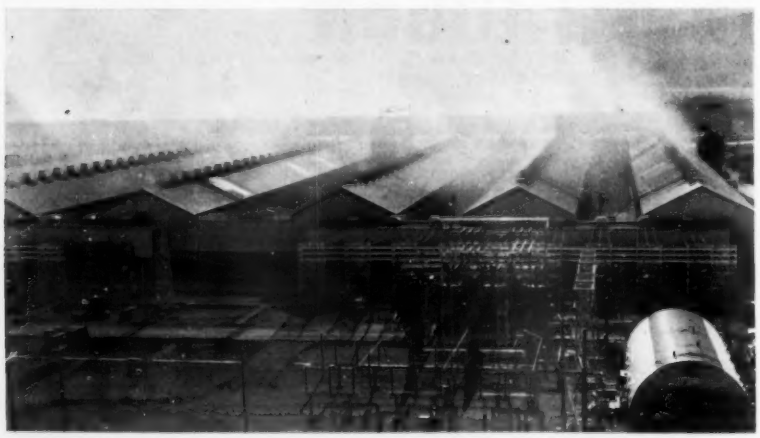
Indian businessmen want machinery and other industrial requirements, as well as licensing or possible capital collaboration with American firms. India's requirements—and natural resources—are said to be limitless, and the Mission believes there is ample opportunity for mutually beneficial trade and investment relationships with India.

NEW MPI MEMBERS

These firms have been elected to membership in the AMERICAN POWDER METALLURGY INSTITUTE, division of the METAL POWDER INDUSTRIES FEDERATION: Sintercast Corp. of America, Bound Brook Bearings Ltd., and Bound Brook Oil-Less Bearing Co. Joseph Dixon Crucible Co. became a member of the METAL POWDER PRODUCERS ASSOCIATION, and Ipsen Industries, Inc., was elected to corporate membership in the POWDER METALLURGY EQUIPMENT ASSOCIATION.

ALUMINUM EXTRUDERS DISCUSS MARKETING

At a recent two-day meeting of the ALUMINUM EXTRUDERS COUNCIL in Pittsburgh, members voted to investigate the possibility of conducting market studies to develop new markets for extrusions.



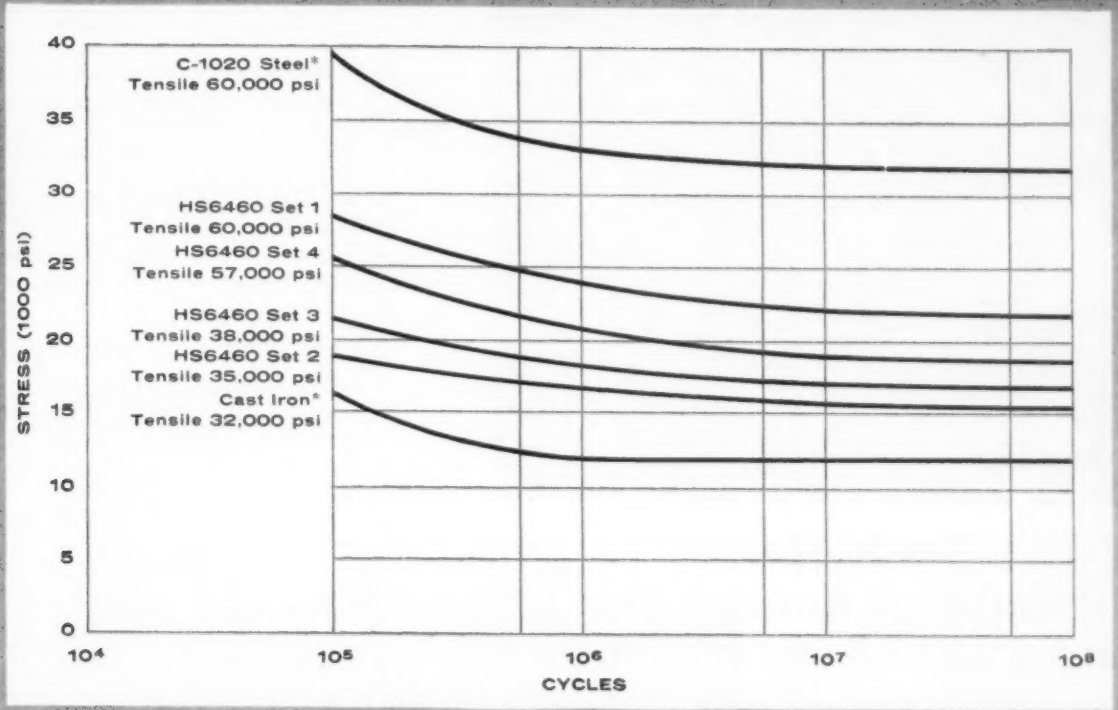
ALCAN'S SMELTER at Kitimat, to be toured by Council members this month.

In addition to technical discussions, the meeting included tours of Latrobe Steel Co. and the Alcoa Aluminum Research Laboratory. These seminars were held:

- *Application of Special Formulae to Die Design and Press Production Capacity,* by Robert Marquardt, Adams Engineering.
- *Anodic Oxidation,* by Ralph Pettit, The Diversey Corp.
- *Marketing Research—Another Tool for Developing New Markets,* by E. M. Strauss, Jr., Alcoa's Commercial Research Dept.

This month, the Council will hold a four-day meeting at Vancouver, British Columbia. One of the highlights of the meeting will be an overnight trip to Aluminium Limited's smelters at Kitimat.

Consolidated Fatigue Test Data on Republic HS6460 High Strength Powder compared with C-1020 Steel and Cast Iron



Procedure Used to Obtain Test Results

Material—Type HS6460 with 1% zinc stearate. Single press and sintered blank machined to standard A.S.T.M. Fatigue Bar—.300" dia. Testing machine—R. R. Moore Rotating Beam.

Sintering conditions for Set 1—Endothermic atmosphere, dew point +30°F, 2050°F, 45 minutes at heat (extended time because of size). Briquetting pressure—100,000 psi. Density—6.83. Combined carbon 0.20%.

Sintering conditions for Set 2—Hydrogen atmosphere, 2050°F, 45 minutes at heat. Briquetting pressure—80,000 psi. Density—6.76. No carbon added.

Sintering conditions for Set 3—Endothermic atmosphere, dew point +30°F, 2050°F, 45 minutes at heat (extended time because of size). Briquetting pressure—60,000 psi. Density—6.36. Combined carbon 0.20%.

Sintering conditions for Set 4—Endothermic atmosphere, dew point +30°F, 2050°F, 45 minutes at heat (extended time because of size). Briquetting pressure—80,000 psi. Density—6.67. Combined carbon 0.20%.

*Data on C-1020 hot rolled steel and cast iron obtained from ASM Handbook, 1948 Edition, Page 119.

For more information, write Republic Steel, Dept. PM-8107, 1441 Republic Building, Cleveland 1, Ohio.

REPUBLIC PROGRESS REPORT

to the POWDER METALLURGY INDUSTRY

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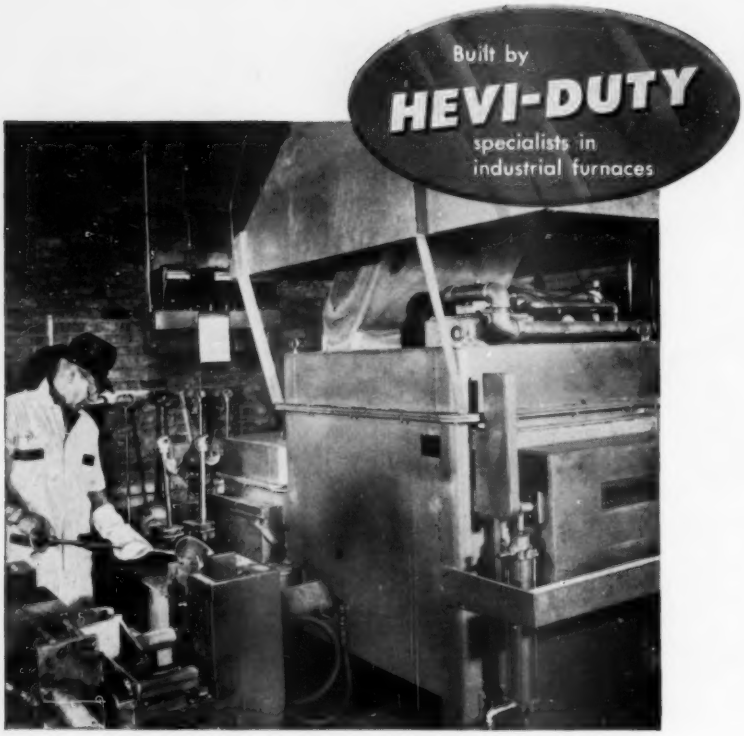

This Combination Melting and Holding Furnace Matches In-Sink-Erator's Requirements

Volume production in limited floor space is one reason why the In-Sink-Erator Company, Racine, Wisconsin, chose a Hevi-Duty Double Chamber Dry Hearth Aluminum Melting Furnace. It covers only 32 square feet of floor space, yet it melts and holds up to 400 pounds of aluminum per hour. The relatively cool furnace exterior has permitted a permanent mold machine to be installed adjacent to the dip-out chamber. In-Sink-Erator, the originator and leading manufacturer of household and commercial garbage disposers, does all of their own permanent molding of disposer shells.

The furnace fits into In-Sink-Erator's time schedule as well as its space requirements. It heats up to operating temperature in only 2½ hours. This means it can be shut down over weekends or at night without excessive loss of production time. Further, the simplicity of this furnace permits minimum maintenance and direct firing provides low fuel consumption.

Write for Bulletin 593 for complete details on Hevi-Duty Melting Furnaces.

- **Industrial Furnaces and Ovens electric and fuel**
- **Laboratory Furnaces**
- **Dry Type Transformers**
- **Constant Current Regulators**

HEVI-DUTY ELECTRIC CO.
Milwaukee 1, Wisconsin

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LATROBE PROMOTES TWO

BURGESS

SAXMAN

Harold C. Burgess, Cleveland district sales manager for LATROBE STEEL CO. for the past 21 years, has been named Ohio regional sales manager. He'll supervise sales and warehousing activities in Cleveland, Dayton, and Toledo. M. W. Saxman III, formerly assistant district manager, succeeds Burgess as Cleveland district manager.

OLIN'S TIFFANY UPPED

TIFFANY

Forrest F. Tiffany has been promoted to director of market development for OLIN ALUMINUM, METALS DIV., OLIN MATHIESON CHEMICAL CORP. He formerly was southwestern regional sales manager.

GOTTHOLD JOINS GORHAM

Edgar I. Gotthold has been named foundry superintendent of the electronics division of the GORHAM MFG. CO. Formerly in charge of the microwave and electronic component foundry at Budd-Stanley Co., he'd also been with Arwood Precision Casting Corp.

Under Gotthold's direction, Gorham is expanding its facilities to incorporate recent advances in casting and foundry techniques. As part of the expansion program, a new investment casting department will specialize in microwave castings in aluminum, magnesium, and copper-base alloys.

METAL POWDERS MOVES; ELECTS OFFICERS

METAL POWDERS LTD has moved its main office from St. Johns to 15 St. Joseph St., Lachine, Quebec. At a recent board meeting, the firm elected these officers: W. N. Hall, president; A. C. Fleischmann, executive vice president; John H. Legg, technical vice president; D. A. Perry, vice president and general manager.

PRODUCE COPPER BILLETS BY CONTINUOUS CASTING

HALSTEAD METAL PRODUCTS INC. has installed high-production casting equipment for copper extrusion billets based entirely on the semi-continuous casting process. Said to be the industry's first, the installation at Zelienople, Pa., is now producing high-quality metal.

Two semi-continuous casting machines, designed and built by LOBECK CASTING PROCESSES INC., are mounted in tandem and fed with liquid metal from a Lectromelt electric arc furnace. Designed to turn out billets of phosphor deoxidized copper at a rate up to 6 tons an hour, the two machines each produce two 7-inch-diameter billets, 12 feet long. These are cut into extrusion billet size by a LOMA high-speed circular saw.

CHICAGO WHITE METAL EXPANDING FACILITIES

CHICAGO WHITE METAL CASTING, INC., is adding 12,000 square feet to its plant at 5239 W. Grand Ave., Chicago, and 10,000 square feet of parking area for employees. The company expects the factory addition to be completed next month.

TECHLINE NAMES AGENTS

TECHLINE DIV., WHEELABRATOR CORP., has appointed four new agents: Lester R. Albert, Jr., Carol Machine Tool Co., Ramsey, N. J., for metropolitan New York and northern New Jersey; Bauer Co., Fort Worth, for Texas; Gene A. Castle for northern Indiana and northwestern Ohio; Robert H. Tiers, Torrington Chemical & Supply Co., Torrington, Conn., for Maine, New Hampshire, Vermont, Massachusetts, Connecticut, and Rhode Island.

with

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Light, rugged, Spincraft ladles save replacement costs, make every pouring job easier! Available in a vast range of sizes, in stainless steel as well as mild.

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LIGHT IN WEIGHT
LESS FATIGUE!

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NON-SPILL SHAPE
NO WASTE!

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EQUIPOISED HANDLE
BALANCED!

Write Today for Complete Data and Prices.

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6 GOOD REASONS
Why You Should Specify
MERRIMAN POWDERED METAL PARTS

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3. DIMENSIONALLY ACCURATE
4. PROVEN PERFORMANCE
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Originators of Sintered Helical Gears.

High Density, precision structural parts from powdered metal in
Brass, Bronze, Copper, Nickel Silver Steel, Iron and Iron Alloys. Copper Infiltration

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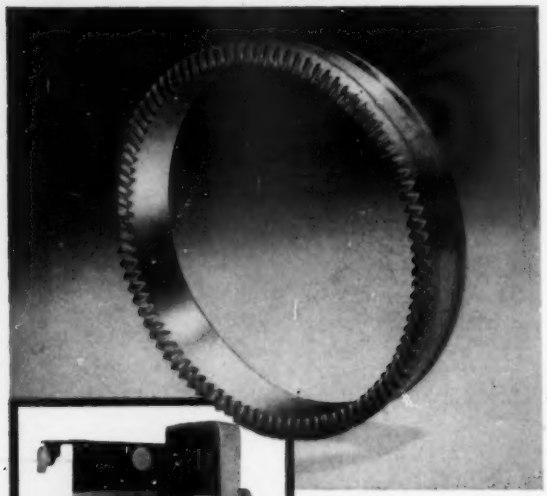
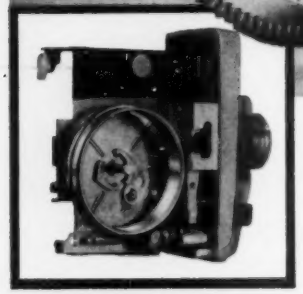
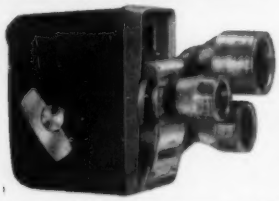
ECONOMIES SUCH AS THIS...







enable Kodak to make precision cameras at the lowest possible price

Eastman Kodak Company switched to **BRASS POWDER METALLURGY** for the motor face gear on the Kodak Medallion 8mm Movie Camera—saving machining and gear cutting.

OTHER MATERIALS either would not take the stress of motor overwind, were too costly to machine, lacked required concentricity or generated 75% process scrap.

THE BRASS POWDER PART* ... eliminated gear cutting ... reduced machining to a minimum ... produced no scrap ... had more than required strength ... perfect concentricity ... AND LOW COST.

*made by The Presmet Corp., Worcester, Mass.

THIS BOOKLET will assist you in evaluating this modern production method in terms of your particular needs.

SEND FOR YOUR COPY TODAY

THE NEW JERSEY ZINC COMPANY
160 Front Street, New York 38, N. Y.

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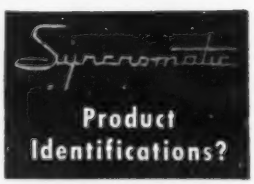
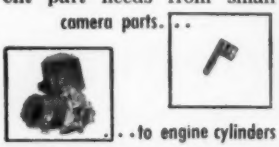
What are your zinc or aluminum die casting needs...



ADVANCE know-how in Zinc and Aluminum die casting design, engineering and production covers a wide range of component part needs from small camera parts...



...to engine cylinders

Moreover, ADVANCE often solves a product sales problem by alert die casting engineering and skills which smooth-up product lines and appearance while at the same time improving casting cycles and lowering part costs.

That is why ADVANCE Zinc and Aluminum die cast parts are important components everywhere in home appliances, office equipment, power tools, gas engines, cameras, surveyors' instruments, electric motors and control devices.

Consult ADVANCE about your die cast parts problems . . . and write for folder "YOUR DOORWAY to Certified Zinc and Precision Aluminum Die Castings."

These symbols are your assurance of highest quality control of zinc and aluminum alloys under ADCI standards.

38 years of service to industry.

ADVANCE TOOL AND DIE CASTING CO.

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Milwaukee 12, Wisconsin

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NEW PRODUCTS

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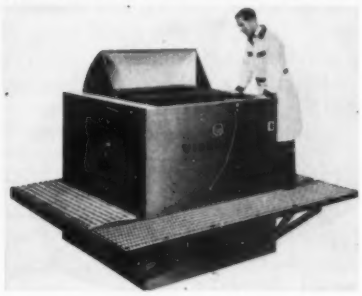
VIBRATING BARREL FINISHER



ROTO-FINISH CO. — The Vibraton is a new machine for mass production cleaning, descaling, radiusing, fine finishing, and coloring of complex cast parts. Time cycles are short and the production rate is said to be 1000% greater than parts processed with conventional barrel finishing techniques.

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PURE MAGNESIA CERAMIC

CORNING GLASS WORKS — A new magnesia ceramic to be used in crucibles for melting high temperature metals. It is capable of long-term operation at temperatures up to 4350° F. The dense, non-porous material is 99.8% pure magnesia. A uniform, fine-grained structure gives it a flexural strength of 15,500 psi at room temperature.

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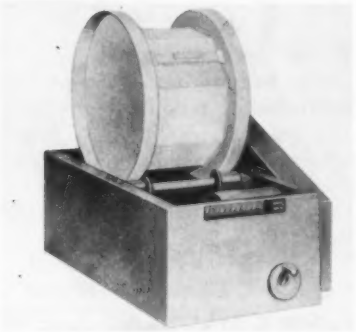
PORTABLE FINISHING BARREL



ALMCO, QUEEN PRODUCTS DIV. — Super Mite, a portable deburring and finishing barrel for laboratory and job shop use. The 12" dia. x 8" wide barrel has a ½ cu. ft. capacity. It is said to be ideal for processing lots of small parts.

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EXTRUSION DIE HEATER

GRIEVE-HENDRY CO. — Easy loading and temperature uniformity of ± 10° F throughout the work space are featured. The unit is available with one or two compartments, each measuring 27" high and having a 14 cu. ft. work space.

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INDICATING CONTROLLERS

THERMO ELECTRIC CO., INC. — Two new electronic instruments that indicate, or indicate and control, any variable that can be converted into an electrical quantity. The instruments feature a high-gain servo-amplifier that provides excellent sensitivity and stability.

Circle No. 245 on Reader Service Card

LOW COST CHEMICAL PUMP

NRC EQUIPMENT CORP. — A simplified titanium gettering pump that utilizes the chemical reaction between gases and titanium vapor to produce vacuums in the 50 micron to 1 x 10^{-9} mm Hg range. The unit is said to cost less than 25% of equipment previously available.

Circle No. 246 on Reader Service Card

continued next page

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ALL DIE CASTERS!

- For advanced engineering in fully automated die casting machines...
- For lowest cost, production-proved automatic ladling for aluminum and vacuum die evacuation (Morton system)...

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THE CLEVELAND AUTOMATIC MACHINE COMPANY
4952 Beech St., Cincinnati 12, Ohio

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COST AND SERVICE STORY

behind Reese Powdered Metal Knobs for Bernz-O-Matic Ceramic Grill

From John B. Spiggle, Purch. Agent for the Otto Bernz Co., Inc.: "Our present brass powdered metal knob was evolved from a smaller knob that was re-designed from a screw machine part to reduce cost. When we required a larger but similar knob on another product, we immediately thought of powdered metal. Reese received the order for this new part because their price and delivery were better than others who had quoted. We have continued to do business with Reese because their prices have been in line and their service and quality better than our other sources for powdered metal parts."

***FREE BROCHURE** "How to Cut Precision Parts Cost with the Remet Powdered Metal Process" shows how the Reese Corp. can help you. Send for your copy today.*

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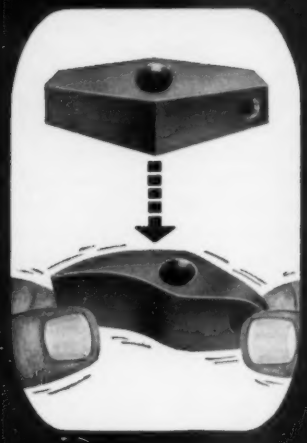
just to *stretch* a point.



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It might stretch your imagination too, if you could see some of the intricate shapes we're casting here at Hitchiner. If you'll write us today for our free new brochure, you'll get an idea how you can utilize the freedom and savings offered with Investment Casting.

For complete details, see this new illustrated, informative booklet on the art of Investment Casting. It could be the best investment you ever made.

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Representatives in Principal Cities

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NEW PRODUCTS

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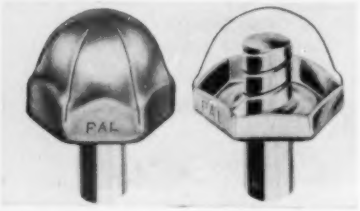
SELF-THREADING NUTS



THE PALNUT CO. — Acorn type self-threading nuts that form their own, deep, clean threads while tightening on unthreaded studs of aluminum, zinc, steel and brass. They are available in ¼" and 3/16" diameters.

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THE RAMPE MFG. CO. — Model 30 is a precision barrel finisher for large-scale finishing, grinding and deburring operations. The unit features a "Floating Power" drive and a built-in magnetic brake. Barrels are interchangeable.

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THE LOFSTRAND CO. — Chemtronic, a new method of paint spraying that utilizes a hydrocarbon compound atomized by an electronic heating element within the unit. This eliminates the use of compressed air. It is noiseless, and has a high lacquer yield.

Circle No. 248 on Reader Service Card

NEW PEENING METHOD

AERO-TEST EQUIPMENT CO., INC. — Perfecto-Peen features a stream of glass beads, microscopic in size and electrostatically suspended in a solution. It is said to strip away scale, corrosion, dirt, burrs and tool marks without altering the dimensions of the basic metal.

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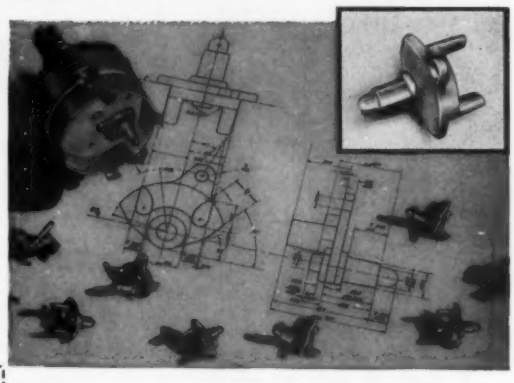
helped create higher rated, longer lasting switch



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UNiversity 4-8080

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FRanklin 5-3361

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ALLEGHENY LUDLUM

Tool Steel warehouse stocks throughout the country... Check the yellow pages

every grade of tool steel... every help in using it

For more information circle No. 2 on the Reader Service Card

CASTINGS FOR HIGH STRESS

continued from page 31

The housing is cast in 355-T 71 aluminum alloy by R. C. Hitchock & Son. Two critical tolerances are held. The 2 bosses, Figure 1a., are cast so they are symmetrical to the 2 trunions (axes). These bosses are held to ±.005. Since everything on the housing lines up with the trunions, the correct machining of the casting depends on holding this tolerance.

Here are the steps necessary to convert the casting into a completed rotor housing:

1. Rough bore the I.D.
2. Skin cut the O.D. to shoulder, then face the solid end for squareness. (Note: The one end is cast solid so the housing can be chucked without interfering with roundness.)
3. Semi-bore the I.D. and face the open end.
4. Cut the solid end off.
5. Mill the bosses to relate them to the centerline.
6. Remove parting line flash.
7. Sand the reverse side of the bosses.
8. Drill and ream 18 holes.
9. Turn both trunions and drill a center hole through them.
10. Drill 8 holes, 4 on each end of the casting.
11. Drill 2 holes.
12. Drill, face and countersink the top holes and the balance of the lugs on the housing.
13. Tap the 2 center holes in the bosses.
14. Mill 12 slots, 6 top and 6 bottom. This provides an air passage which prevents air resistance from building up in the housing.
15. Finish mill the bosses.
16. Finish bore, chamfer and face the I.D.
17. Bore the center holes in the trunions.
18. Countersink all drilled and tapped holes.
19. Tap 8 additional holes.
20. Deburr completely.
21. Wash housing.
22. Barrel finish to smooth off hand deburring marks.
23. Final inspection.

After finishing, the end plates are mounted on the housing for deflection control of the rotor mass. Next, the torque ring is mounted on the two bosses. The O.D. of the torque ring is ground. This must be concentric to .0002. Finally, the trunions are burnished to give a hardness effect. The completed rotor housing is then ready for assembly.

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Plant producing automotive parts and accessories. Familiar with small assemblies of die cast components. Must be experienced in supervising from research and development and tooling through conveyorized line production. Familiarity with die casting essential. Production processes include die casting and tooling, light machining, stamping, buffing, chrome plating and conveyorized assembly. Age limits approximately 40 to 50. Salary open. Applicants without specified background will not be considered. Submit resume before interview. Nelmor Manufacturing Corporation, 26420 Lakeland Boulevard, Euclid, Ohio.

FOUNDRY FOREMAN
NON FERROUS

Growing electrical manufacturer located in the South East seeking foundry foreman with five to ten years experience in Non Ferrous foundry operations. Prefer experience in casting small repetitive type products. We offer excellent salary with Company paid benefits and growth opportunity. Our employees know of this Ad. Please send complete personal, professional and educational resume to Box 8159.

DIE CASTING — DIE DESIGNER

The Western Electric Co., Manufacturing and Supply Unit of the Bell Telephone System, has immediate opening in Baltimore, Md., for design engineer experienced in the design of aluminum die casting dies. Graduate engineer preferred but will consider equivalent experience and education. In addition, experience in injection mold design and tool and die design desirable. This is an excellent opportunity in a progressive company. A personal interview in Baltimore (expenses paid) will be arranged for qualified candidate. Liberal relocation allowance will be granted if employed. For a prompt reply write to Western Electric Company, Employment Manager, 2500 Broening Highway, Baltimore 24, Maryland, giving age and a brief outline of education and experience.

POSITIONS WANTED

Die Cast management-engineer with twenty years experience wishes to contact party interested in setting up his own die cast shop. Will consider taking over management of established shop with growth possibility. Box 8259.

REPRESENTATIVES WANTED

JOBBERS WANTED

We manufacture Kob-Kleen (ground corn cobs) for deburring, burnishing, polishing and soft grit blasting of metals; metal stamping absorbants, etc. Nationally advertised. Coeval, Inc., Dept. J, St. Joseph, Illinois.

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Established manufacturers agency, offices Chicago and Detroit, selling Illinois, Michigan, Wisconsin, Minnesota, Iowa, Indiana and Ohio wishes to represent reputable die caster with plating and painting facilities and experienced in appliance field. Box 8359.

Opportunities rates: $20 for the first column-inch; $15 for each additional column-inch payable in advance. To answer box number advertisements, address responses to the box at Precision Metal Molding, 812 Huron Rd., Cleveland 15, Ohio. Closing date: 1st day of month preceding publication.

Bunting makes the "almost impossible" bearings and parts

The photograph shows a sintered bronze bearing used in an exceedingly popular home laundry drier. It offers several unusual features, some of which you may find useful in designs you are considering as sintered parts. In the first place because the splines on the O.D. of the bearing abut the back of the bearing flange, this is a part which would be almost impossible to produce by machining but can readily be produced by powder metallurgy.

Second, the splines do not extend the full length of the bearing but the density of the splines must be the same as the remainder of the bearing. This requires intricate and unusual tooling and understanding of the problem which is one of the reasons why this manufacturer put his design in the hands of Bunting.

For the unusual, as well as the usual, in bearings, bushings, bars and special parts of cast bronze, sintered metals or Alcoa aluminum, see Bunting first.

BUNTING SALES ENGINEERS in the field and a fully staffed Product Engineering Department are at your command without cost or obligation for research or aiding in specification of bearings or parts made of cast bronze or sintered metals for special or unusual applications.

...ask or write for your copy of

Bunting's "Engineering Handbook on Powder Metallurgy" and Catalog No. 58 listing 2227 sizes of completely finished cast bronze and sintered oil-filled bronze bearings available from stock.

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Remove loose flash and clean the mold with a powerful, clean air blast — then lubricate all mold surfaces evenly, *using the same gun* —with a flick of the thumb! Adjustment *at the gun* for full range from zero to a heavy mist, spraying, fogging, or vaporizing the lubricant. Speeds up mold operation and reduces casting rejects. Makes every machine cycle count.

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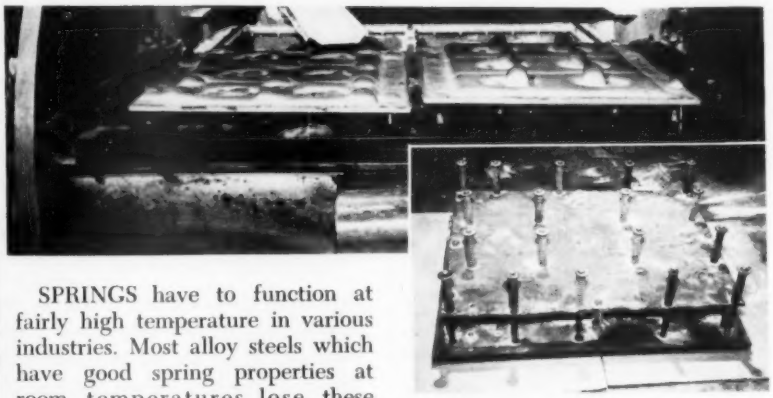
Increase Pin Spring Life



SPRINGS have to function at fairly high temperature in various industries. Most alloy steels which have good spring properties at room temperatures lose these characteristics when worked for long periods at only a few hundred degrees above ambient temperature. The knockout pins on shell molding machines are an example. Here, springs are needed to return the pins to their starting position. Failure of a pin can ruin a mold.

Ordinary steel springs in this service have a useful life of from 40 to 100 flexure cycles. When a spring breaks, all the molding equipment is out of service for at least 30 minutes.

By replacing the steel springs with springs made from Haynes alloy no. 25, the life of the springs is tremendously increased. Where normal spring life was not in excess of 100 flexures, the no. 25 springs are still going strong after 12,000 flexures.

Because this alloy is age hardened at 1100°F, it can be safely worked at all temperatures up to about 1000°F.

DATA OFFERED IN THIS MONTH'S ADS

the Reader Service Cards facing the last page will get you these free reference materials. Circle the numbers and mail.

1. **Precision Die Castings** — "Your Doorway to Certified Zinc and Precision Aluminum Die Castings", is a brochure from Advance Tool & Die Castings Co., on their know-how in die casting design, engineering and production.

2. **Tool Steels** — Publication list from Allegheny Ludlum Steel Corp. describes 125 technical publications on tool steels which are available.

3. **Sinterings** — Engineering Bulletin 3020 from American Sinteel Corp. gives technical data on ferrous and non-ferrous powdered metal products and their design.

8. **Investment Casting** — 'Practical Guide to Investment Casting", is a 44-page design handbook from Arwood Precision Casting Corp.

10. **Trim Presses** — B & T Machinery Co. offers to show why its hydraulic die castings trim presses are exceedingly fast and efficient.

11. **Sintering** — The "Engineering Handbook of Powder Metallurgy", and Catalog No. 58, which lists 2,227 sizes of completely finished cast bronze and sintered oil-filled bearings, are available from Bunting Brass & Bronze Co.

13. **Investment Cast 17-4PH** — Cannon-Muskegon Corp. offers the ICI technical research report on the effect of aging time and temperature on the mechanical properties of investment cast 17-4PH.

14. **Refractory Shapes** — If you work with aluminum holding or alloying furnaces, you should get data on refractory shapes from Refractories Div., The Carborundum Co.

15. **Die Casting Machines** — Complete line of Cast-Master die casting machines is described in Catalog CM-100 from H-P-M Div., Koehring Co.

17. **Die Castings** — Brochure from Di Salle Plating & Die Casting Co., presents a picture story on their facilities for making your specialized die castings.

18. **Standard Unit Dies** — Literature from Detroit Mold Engineering Co. tells how to make die changes in minutes when die casting zinc or aluminum.

20. **"Small Die Castings Exclusively"** — is the title of a bulletin from Gries Reproducer Corp. The company's method for delivering parts of high uniformity, with close tolerances, is explained.

22. **Zinc Die Casting Facts** — Henning Bros. & Smith, Inc. has issued an engineering data book on "Die Casting With Zinc Base Alloys".

23. **Furnaces** — Engineering Bulletin 593 from Hevi-Duty Electric Co., gives complete details on their line of melting furnaces.

24. **Investment Casting** — Brochure from Hitchiner Mfg. Co., gives technical data on utilizing the freedom and savings offered with investment casting.

28. **Induction Melting** — Technical Bulletin No. 70 from Inductotherm Corp. discusses the cost-saving features of their high-frequency induction melting equipment.

29. **Die Casting Machines** — Completely new catalog from Kux Machine Co. illustrates the features and models of a new line of Kux die casting machines.

30. **Induction Heating Units** — from Lepel High Frequency Laboratories, Inc., for brazing, melting, annealing, etc. are presented in an engineering catalog.

32. **Extrusion Die Steels** — Technical bulletin from Latrobe Steel Co. on their Viscount 44 prehardened, machinable hot work steels that save heat treat time on extrusion tooling.

33. **Die Casting Machines** — Lester-Phoenix, Inc., wants you to check the specifications on its die casting machines if obsolete equipment is stealing your profits.

37. **Zinc Die Castings** — The latest edition of "End Uses of Zinc Die Castings", is available from The New Jersey Zinc Co.

38. **Cutting Costs** — with brass powder metallurgy. Engineering data booklet evaluates this production method in terms of particular needs. The New Jersey Zinc Co.

40. **Cleans, Lubricates** — That's what the Air-Lube System, manufactured by Pierce-Waller, Inc. does. Technical data sheets are available.

41. **Sintering Savings** — A technical report, "How To Cut Costs With The Remet Powdered Metal Process", is available from Reese Metal Products Corp.

42. **High-Strength Powder** — Republic Steel's latest progress report gives fatigue test data on Republic HS-6460 high-strength powder compared with C-1020 steel and cast iron.

43. **Ladles & Skimmers** — Technical data and prices are available from Spincraft, Inc. on their stainless steel ladles and skimmers.

45. **Statistical Quality Control** — for die castings. Technical literature, from Stroh Die Casting Co., Inc., describes the use of quality control for lower inspection costs.

47. **Die Facilities** — Zuelzke Tool & Engineering Co. Inc. offers information on its shop for making die casting dies, including design and engineering service.

48. **Corrosion Protection** — Technical manual from Allied Research Products, Inc., tells about chromate conversion coatings and clear protective coatings.

49. **Automatic Finishing Machines** — Clamps and fixtures, mask washing machines, and spray painting masks are described in technical literature from Conforming Matrix Corp.

50. **Coatings** — for chemically polishing, deburring and protecting zinc and aluminum die castings are described in technical data sheets from Heatbath Corp.

51. **Finishing Zinc Die Castings** — Minnesota Mining and Mfg. Co. offers data on a new tumbling medium said to give super-fine pre-plating surfaces on zinc die castings.

61. **Die Steel** — Thermold AV, a vacuum degassed die casting die steel, is said to assure longer production runs. Details are available from Universal Cyclops Steel Corp.

62. **Master-Molds** — and cavity blocks, where you shoot in the lower position and mold vertically, are described in engineering data from Richards Tool & Mold Co.

Die Cast Engine Block Design

THE BLUE PRINT for a die cast aluminum V-8 engine block is examined by F. J. Koegler, and A. F. Bauer, of Doehler-Jarvis Div., National Lead Co. A section of the cast block is in the foreground.

THE DIE CAST aluminum V-8 engine block is one step closer to reality. Its design is covered in a patent issued to Alfred F. Bauer, assistant general manager and chief engineer of the Doehler-Jarvis Div., National Lead Co. (Patent is assigned to National Lead Co.)

The design, which can apply to all V-8 engine blocks, eliminates undercuts, projections and blind passages, and allows for the efficient mass production of engine blocks by die casting. In addition, the design permits smooth, uniform lubricating and cooling passages to be cast directly into the aluminum block. This permits unobstructed flow of the fluids used.

There is a longitudinal oil passage formed between the block and a separately cast cam shaft housing. This passage provides improved lubrication of crank shaft and cam shaft bearings, as well as valve tappets. Most important, it eliminates costly machining operations required to drill lubrication passages. Double wall construction is used to increase strength and rigidity.

By die casting, the engine blocks can be turned out faster and more economically than current means of fabrication. Aluminum blocks develop more horsepower per pound than conventional gray iron blocks. A substantial cost savings can be realized through the small amount of machining required on the aluminum blocks.

The weight of a die cast aluminum block for an average V-8 engine is 55 pounds, a weight saving of over 150 pounds.

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FIRST in commercial production and sale of zinc base die casting alloy ingot containing 4% aluminum made from high grade zinc. Production started October, 1924.

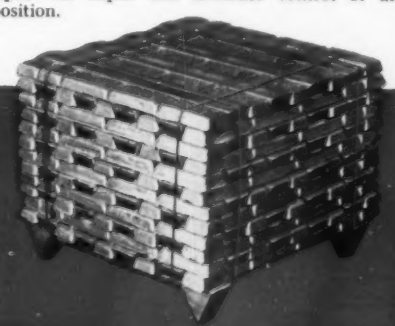
FIRST to use 99.99 plus pure zinc when it became available in 1928.

FIRST to develop the lower magnesium contents, .03 to .05%, which eliminated the hot shortness characteristics experienced with .10% magnesium and at the same time was sufficient to prevent the intercrystalline corrosion. Apex promoted in 1931 the first ASTM specification written for zinc base die casting alloys.

FIRST to establish and publish information on the effects of metal and die temperatures on different alloy compositions through actual die casting of thousands of test bars. Apex "Metalgrams" showing these effects were initiated in 1931 and continued through 1945.

FIRST to use large capacity refractory lined furnaces for alloying, replacing the conventional iron metal pots. The larger heats established a uniformity of composition not previously attainable. Iron pickup also was eliminated.

FIRST to employ Quantometers—direct reading spectrographs—for rapid and accurate control of alloy composition.



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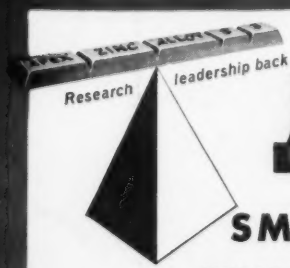

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